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MEDICINE BOW
NATIONAL FOREST
Laramie, Wyoming

CHEYENNE STAGE II WATER DIVERSION PROPOSAL

Final Environmental Impact Statement

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FINAL ENVIRONMENTAL IMPACT STATEMENT
02-06-80-02

Cheyenne Stage II Water Diversion
Medicine Bow National Forest

Lead Agency:	USDA Forest Service
Cooperating Agencies:	USDI - Fish and Wildlife Service
	USDI - Bureau of Land Management
	Department of Defense - Army Corps of Engineers
	Environmental Protection Agency
	Wyoming Game and Fish Department
Responsible Official:	Craig W. Rupp Regional Forester Rocky Mountain Region 11177 W. 8th Ave., Box 25127 Lakewood, Colorado 80225
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Date Draft Environmental Impact Statement Made Available to EPA and the Public: May 19, 1980. RDEIS: May 4, 1981

Date Final Environmental Statement Made Available:

Abstract: The Cheyenne Board of Public Utilities (CBPU) has submitted a Statement of Need and Application to expand its water collection system. Their proposed action is called Stage II. This proposed action would expand the collection area in the Sierra Madre Mountains southwest of Encampment, Wyoming; increase the capacity of Hog Park and Rob Roy Reservoirs; collect water out of Douglas Creek and Lake Creek drainages near Keystone, Wyoming; and involve the installation of pipe for collection and transmission of water. This Environmental Impact Statement describes the CBPU proposed action and eight alternatives. These alternatives were evaluated and all but five were eliminated from detailed study. Those considered in detail include: Alternative A (No Action), Alternative B (Cheyenne Board of Public Utility Proposed Facilities with Modification), Alternative C which is the preferred alternative (Modify Stage I Collection System to Increase Capacity), Alternative D (Construct a Lower Reservoir in the North Fork of the Little Snake River and Pump Water into the Existing System) and Alternative E (Combine Water Conservation, Agriculture Water Right Purchase and Groundwater Development.)

SUMMARY

A. PURPOSE AND NEED

Because of expanding energy development in Wyoming, the capitol city of Cheyenne has foreseen a considerable increase in population. This population increase would put demands on the municipal water system in excess of present supply. Cheyenne has forecasted demand to exceed supply sometime in the 1980's. Cheyenne has anticipated a negative impact on the quality of life of its citizens if municipal supplies are not increased. The Cheyenne Board of Public Utilities explored other supply sources from the North Platte River, Laramie River, surface water from the mountains near Cheyenne and groundwater. After exploring these alternate sources CBPU selected expansion of the Stage I system which was developed on Medicine Bow National Forest land in 1962.

This Final Environmental Impact Statement (FEIS) describes a proposed action and the alternatives for allowing the Cheyenne Board of Public Utilities (CBPU) to expand their Stage I water collection and transmission facilities on the Medicine Bow National Forest. The expansion proposal of these facilities has been referred to in the CBPU request as Stage II.

The CBPU has submitted an application for a special use permit. The USDA Forest Service must decide whether or not to issue occupancy documents in response to the CBPU request. There would also be permits or documents issued by the Army Corps of Engineers (COE), Bureau of Land Management (BLM), the Wyoming Department of Environmental Quality (DEQ), and Wyoming State Engineer's Office (WSEO).

The construction elements involved in the expansion request are:

-construction of new access roads,
-installation of water diversion structures in streams,
-installation of pipelines,
-and increasing the capacity of two storage reservoirs.

Chapter II describes each element in detail and the consequences of these construction elements are outlined in the table, Summary of Environmental Impacts, found at the end of this chapter and described in Chapter IV.

The preparation of this FEIS disclosing the CBPU proposed action and alternatives is required by the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) - NEPA Regulations 40 CFR 1500. The format used is established in CEQ regulation 1502.10.

The purpose of this FEIS is to evaluate the CBPU proposed action and disclose the environmental consequences resulting from this proposed action and the alternatives.

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There have been 14 public issues identified as a result of:

-public meetings
-open response forms
-responses to the Huston Park Plan
-interagency scoping sessions
-comments on the original DEIS
-Revised Draft Environmental Impact Statement

The identified public issues are:

-alternative water sources to Stage II
-increased stream flows
-decreased stream flows
-reservoir fluctuation
-Colorado River salinity
-new access into unroaded areas
-fish habitat
-downstream water users
-threatened or endangered species
-terrestrial wildlife impacts
-water supplies to other communities
-reservoir safety
-development of compact allocated water
-role of water conservation maximized

Through a review of these public issues and interagency meetings with cooperative agencies, the following management concerns were developed:

-effects on fisheries
-effects on recreation
-effects on soils
-effects on range
-effects on terrestrial wildlife
-effects on visual management
-effects on the tree covered area
-effects on the cultural resource
-effects on social structures
-effects on threatened or endangered species

These public issues and management concerns are combined to provide the range of issues and resource elements used to compare the proposed action and alternatives in terms of the environmental impacts associated with them. The comparisons are exhibited in the table at the end of this chapter and are described in Chapter IV.

B. ALTERNATIVES INCLUDING THE PROPOSED ACTION

In response to the CBPU proposed action, public issues and management concerns, a range of alternatives were developed. All of the

alternative actions were evaluated in light of their feasibility and the available data. Several of these alternatives were eliminated in whole or in part from detailed study for various reasons. The following are the alternatives examined but eliminated from detailed study in this FEIS:

-CBPU Proposed Action
-growth management
-weather and stream flow modification
-pump from Hog Park to Rob Roy Reservoir
-pump from North Platte River at Boat Creek confluence to Rob Roy Reservoir
-pump from North Platte River near North Gate, Colorado, to Pole Mountain

The reasoning for eliminating each of these alternatives is in Chapter II. Discussions of secondary impacts from excess water supplies are included in Chapter IV.

The alternatives which have been considered in detail in this FEIS are:

1. Alternative A: NO ACTION

   Under this alternative a permit for development of additional water would not be issued. The city of Cheyenne would continue to be supplied as in the past from their Stage I facility, wells in Laramie County, and from Middle Crow Creek. The CBPU operation and facilities would remain in their current status on National Forest Land, and yield approximately 14,700 acre-feet annually.

2. Alternative B: PERMIT PROPOSED FACILITIES WITH MODIFICATION.

   This alternative would allow development of all the proposed facilities but with specified modification and mitigation stipulations. Alternative B proposes the development of Douglas Creek water for delivery to the Pole Mountain area with replacement water furnished by facilities on the Little Snake, as has historically been the case in Stage I. The potential average annual yield from the proposed Douglas Creek drainage facilities is approximately 28,100 acre-feet, however only 26,900 acre-feet, which matches the payback, could be used. A comprehensive outline of available supplies from Douglas Creek is presented in the 1977 Banner Report on Proposed Expansion of Cheyenne's Douglas Creek Facilities.

   The potential yield of the existing Stage I facilities in the Douglas Creek drainage is approximately 13,000 acre-feet per year. Currently, 7,400 acre-feet are being used because this amount equals that paid back from the Little Snake Collection System. It is proposed that diversion and storage facilities

in the Douglas Creek drainage would be enlarged and expanded to increase the average annual Douglas Creek yield to 26,900 acre-feet. The west slope collection facilities, sized to produce an average annual yield of 26,900 acre-feet, would convey west slope water through the transcontinental divide tunnel and into Hog Park Reservoir. This alternative would yield Cheyenne a total of 34,200 acre-feet available from all sources. A detailed analysis of the water supplies available from an expansion of the Little Snake diversion system is presented in the Report on Proposed Expansion of Cheyenne's Little Snake Diversion Facilities (Banner and Associates, 1976).

3. Alternative C: MODIFY STAGE I COLLECTION SYSTEM TO INCREASE CAPACITY AND EXTEND THE PROPOSED SYSTEM TO THE VICINITY OF WEST BRANCH OF THE NORTH FORK LITTLE SNAKE RIVER (PREFERRED ALTERNATIVE).

   Under this alternative, the Stage II collection facilities in the Little Snake drainage would be extended only to the West Branch and some of its tributaries. The Roaring Fork and its tributaries would not be diverted. The Stage I diversion system in the Little Snake drainage would be modified to transfer Ted Creek water into the Stage II pipeline. This would increase the diversion efficiency of the remaining Stage I system. Approximately one half mile of additional pipeline would be required from Third Creek to Ted Creek.

   Alternative C would involve the development of Douglas Creek water for transmission of 23,200 acre-feet to the Pole Mountain area. The west slope facilities in the Little Snake River drainage would be designed to collect an approximate total of 23,200 acre-feet a year. This water would pass through the transcontinental divide tunnel and into Hog Park Reservoir. This alternative would yield Cheyenne a total of 30,500 acre-feet of water available from all sources.

4. Alternative D: CONSTRUCT A RESERVOIR LOWER IN THE NORTH FORK OF THE LITTLE SNAKE RIVER AND PUMP WATER INTO THE EXISTING SYSTEM.

   This alternative would change the concept of the original proposal. A reservoir would be constructed on the North Fork of the Little Snake River at the confluence of the West Branch. It would impound stream water during the high runoff period. This reservoir would provide an additional average annual yield for Cheyenne, of 18,000 acre-feet. A pumping station at the Little Snake Reservoir would deliver water through a transmission pipeline to the west portal of the transcontinental

divide tunnel. From the west portal, water would flow by gravity through the tunnel and into Hog Park Reservoir. There would be no need to construct the Little Snake diversion pipeline system. This alternative would produce for Cheyenne a total of 32,700 acre-feet of water available from all sources.

5. Alternative E: COMBINE WATER CONSERVATION, AGRICULTURE WATER RIGHTS PURCHASE AND GROUNDWATER DEVELOPMENT.

   This alternative would provide for a substantial reduction in construction on Federal surface while supplying approximately 13,000 acre-feet of additional water annually. Water conservation would be instituted over a 30 year period reducing consumption by 10% each decade up to 2010. The average savings would be about 5,100 acre-feet a year after the year 1995 (Calculations-Chapter II, pp. 38-55).

   Agricultural rights would be purchased from willing sellers. This could gain up to 8,000 acre-feet which would allow for the use of the 4,100 acre-feet currently stored in Rob Roy Reservoir plus 3,900 acre-feet which could be developed from Lake Creek and other collectors in Douglas Creek tributaries. The water purchased would be released directly into the North Platte system as payback water, eliminating the need for the Little Snake collection system.

   There would be 5,000 acre-feet of groundwater developed. This is the smallest amount of water economically feasible to develop and would contribute the least cost to the combined system. A pump and pipeline system would be developed off the National Forest.

   Development of facilities would include: enlarging the Douglas Creek-Lake Owen pipeline to transmit 15,400 acre-feet to the Pole Mountain area, developing the Lake Creek Diversion, enlarging the Lake Owen-Pole Mountain pipeline and installing the Pole Mountain pipeline. This combined alternative would yield Cheyenne a total of 27,700 acre-feet a year available from all sources 1/.

The Summary of Environmental Impacts table, at the end of this Summary and Chapter II, summarizes the effects of Alternatives A, B, C, D, and E with respect to public issues and effects on resource elements.

1/ Cheyenne currently receives 7,400 acre-feet from Stage I Douglas Creek development and 7,300 from wells and other sources for a total of 14,700 acre-feet. The 7,400 from Douglas Creek Stage I + 4,100 acre-feet currently stored and unused in Rob Rob Reservoir + 3,900 acre-feet from the Douglas Creek-Lake Creek system = 15,400 acre-feet. This 15,400 + 7,300 from other sources + 5,000 from new wells = 27,700 acre-feet.

C. AFFECTED ENVIRONMENT

The area which would be affected by the proposed action encompasses a large portion of southcentral and southeastern Wyoming in Carbon, Albany and Laramie counties.

Three areas of the Medicine Bow National Forest would be affected. These areas are:

- The Sierra Madre Mountains sector located southwest of Encampment, Wyoming, would contain most of the diversion structures. The water collected here would be used as payback into the North Platte system.

- The Medicine Bow Mountains sector located southwest of Laramie, Wyoming, would supply the water transmitted to Cheyenne.

- The Pole Mountain sector east of Laramie, Wyoming, would be used as the drop where collected water leaves the pipeline and enters the Crow Creek drainage for transport to Granite and Crystal, Cheyenne's two storage reservoirs.

The proposed action would affect the following resource elements:

- socioeconomic
- watershed
- fisheries
- recreation
- wilderness
- soils
- range
- wildlife
- threatened or endangered species
- visual resources
- tree resource
- transportation
- mineral management
- cultural resources
- air quality

The specific effects on these resource elements are discussed fully in Chapter III, "Affected Environment", and reported in Chapter IV, "Environmental Consequences."

Impacts on the affected environment would be mitigated either on-site or in an area which would provide similar benefits. The entire proposed mitigation plan is located in Chapter II, section E "Alternatives Considered in Detail" and includes all wildlife and fishery mitigation found in the U.S. Fish and Wildlife Service Coordination Act Report in Appendix II, Section 10, Revised Draft Appendix.

D. ENVIRONMENTAL CONSEQUENCES

The potential environmental consequences of the alternatives are described in terms of the net effect of an action on the physical, economic, biological and social environments. All alternatives have the potential for physical and biological impacts, but the degree of effect would vary.

Evaluation of these consequences has been made in light of the social and economic needs of the area affected by the proposed action and alternatives. The environmental effects on the physical and biological components vary as a function of the alternative considered. Alternative A is the no action alternative and represents the current situation. This does not mean that the current situation is the most environmentally desirable, however. The amount of variation in environmental impacts between alternatives comes from both the method of implementing an action and the amount of land area involved with an alternative.

The following is a summary discussion of the environmental consequences of each alternative. The mitigating measures have been incorporated into these discussions and the detailed discussions are in Chapter IV "Environmental Consequences". A more complete presentation of the impacts is in the table at the end of this chapter.

Alternative A.

This alternative would maintain conditions in their current state. There would be no increase in water supply by diversions on National Forest land. Other sources would have to be developed or water conservation would have to be instituted to extend the supply available to Cheyenne for any period of time. The year 1977 was the most recent drouth year. Conservation measures at this level, 187 gallons per capita per day (GPCD) all uses, should make enough water available until approximately 1990 with an average growth rate of 6% a year. A low growth rate of less than 4% per year, plus a graduated conservation program of 30% reduction in use over a 30 year period, could extend current supplies to 2040. Under Alternative A, any price increases to consumers would result from increased costs for current system operations.

Under Alternative A, fisheries population and habitat losses associated with inadequate maintenance and flushing flows in Stage I diverted streams would continue to exist; however population and habitat loss due to construction, a further reduction in flows, and greater access would not occur. The flow below the Douglas Creek diversion structure would remain at one cubic foot per second (cfs) rather than be increased to 5.5 cfs. Hog Park and Rob Roy Reservoirs would not be enlarged as they would be in Alternative B, C, or D. Therefore, 9.7 miles of naturally reproducing brook and brown trout streams would not be inundated. The lower reservoir in the Little Snake drainage would not be built eliminating the need

to inundate 4.9 miles of naturally reproducing cutthroat, rainbow, and brook trout habitat.

Mitigation measures would not be required. There would be no additional roads or diverted streams. Area IV (5,210) acres could be recommended for inclusion in the proposed Huston Park wilderness.

This alternative would resolve the fewest public issues of any action. Alternative A would not sufficiently meet water development goals in the state and county land use plans.

Alternative B.

This alternative would permit the full facility development (as modified) in the area that the CBPU applied for. Alternative B is the Cheyenne Board of Public Utilities proposal with environmental restrictions and mitigation measures added to make it environmentally acceptable.

This alternative could supply Cheyenne with water beyond the year 2070, but it would require water conservation. Further conservation would be needed if this date were to be extended. At the present rate of consumption, (242 GPCD all uses) the period of supply could vary from 2011 to past 2070 depending on the growth rate. Cost to the consumer would be more than twice current costs for water. Salinity at Imperial Dam would increase between 1.89 and 2.17 milligrams per liter (mg/l). This converts to $469,000 in damages per milligram or from $886,410. to $1,017,730. for this alternative (Table III-7, p. 120). Salinity has, however, decreased 100 mg/l at Imperial Dam since 1972 (Salinity Control Forum, 1980, p. 8).

Rob Roy and Hog Park Reservoirs would be increased, inundating an additional 1,078 acres of terrestrial wildlife habitat; 1,000 of these acres would be mitigated. Under this alternative, development in the North Fork and Roaring Fork of the Little Snake River drainage and in the Douglas Creek drainage would include diversion structures on nine fishery and 21 non-fishery streams in the Little Snake River drainage, and four fishery and 12 non-fishery streams in the Douglas Creek drainage. Additional Stage II water would be released into Hog Park Creek and the Encampment River. A pipeline would be required to transport water off of National Forest System land on Pole Mountain, instead of allowing additional water to be released into Middle Crow Creek, to avoid cause channel damage and fish habitat loss. The Stage I diversion structures in the North Fork of the Little Snake River drainage would be modified to increase the diversion efficiency of that system.

Maintenance and flushing flows would be provided in all Stage I and Stage II streams supporting fish populations in both the Little Snake and Douglas Creek drainages. Blanket minimum flows would be provided in all non-fishery streams to maintain riparian habitat and seasonal reproductive use by trout populations.

The pipelines would extend to Roaring Fork, as would the road system. Alternative B results in the fewest acres available as potential wilderness.

Alternative B would comply with the state and county land plan goals and would provide for positive resolution of many identified public issues.

Alternative C. (Preferred Alternative)

Alternative C would permit the development of only a portion of the CBPU proposed collection facilities. Under this alternative, the Stage II collection facilities in the Little Snake River drainage would be extended to the West Branch and some of its tributaries. There would be less water than provided by Alternative B, and there would be less area developed which would require mitigation.

The cost to the consumer would be approximately 8% more than Alternative B, but overall construction costs would be less. This alternative could supply Cheyenne past the year 2070 but it would require water conservation practices. Further conservation would be needed if this date were to be extended. At the current use rate (242 GPCD all uses) the period of supply could vary from 2004 to beyond 2070 depending on the growth rate. Salinity at Imperial Dam would increase between 1.53 and 1.76 mg/1. The damage is currently $469,000 /mg, or from $717,570 to $825,440 for this alternative (Table III-7).

Rob Roy and Hog Park Reservoirs would be increased to the same size, as in Alternative B. This would result in a mitigation gain for terrestrial wildlife habitat with 992 acres lost and 1,000 mitigated. The Roaring Fork and its tributaries would not be diverted. This would result in diversion structures on seven fishery and 12 non-fishery streams. Complete development would occur in the Douglas Creek drainage which would require diversion structures on four fishery and 12 non-fishery streams. Additional Stage II water would be released into Hog Park Creek and the Encampment River. A pipeline would be required to transport water off National Forest land on Pole Mountain, instead of allowing additional water to be released into Middle Crow Creek, to avoid channel damage and fish habitat loss. The Stage I diversion structures in the North Fork of the Little Snake River drainage would be modified to increase the diversion efficiency of that system.

Maintenance and flushing flows would be provided in all Stage I and Stage II streams diverted in both the Little Snake and Douglas Creek drainages. This includes maintenance and flushing flows in all streams supporting fish populations and a blanket minimum flow in all non-fishery streams to maintain riparian habitat and seasonal reproductive use by trout populations.

The pipelines and road access would extend only to the West Branch of the Little Snake area. Approximately 3,780 acres of Area IV would be available for inclusion into the proposed Huston Park Wilderness.

This alternative would comply with 87% of the goals in the state and county land use plans. Alternative C would resolve public issues nearly as well as Alternative B. Alternative C only partially resolves the public issues of "Water Supplies to Other Communities" and "development of compact allocated water," however Alternative C more fully resolves the expressed public concern about "Colorado River Salinity."

Alternative D.

This alternative would require a reservoir in the lower North Fork drainage. Water would be pumped from the new reservoir to the tunnel under the Continental Divide which transports Stage I water to Hog Park Reservoir.

Alternative D is the most expensive to construct and has annual energy costs in excess of $2,000,000. This alternative could supply Cheyenne beyond the year 2070, but it would require water conservation. Additional conservation would be needed to extend this date. At the current use rate (242 GPCD all uses) the period of supply could vary from 2008 to beyond 2070 depending on the growth rate. Costs to the consumer would be more than triple the present cost. Salinity at Imperial Dam would increase between 1.89 and 2.17 mg/1. Current annual damage is $469,000/mg. This is $886,410 to $1,017,730 in damages for this alternative.

There would be no collection system developed from the west end of the Stage I system to Roaring Fork. Some impacts outlined in Alternatives B and C associated with diverted streams would not occur. The seven Colorado River cutthroat trout streams, two brook trout streams and 21 non-fishery streams in the Little Snake drainage would not be affected by water diversion, however complete development would occur in the Douglas Creek drainage including diversion structures on four fishery and 12 non-fishery streams. Rob Roy and Hog Park Reservoirs would be enlarged. Additional Stage II water would be released into Hog Park Creek and the Encampment River. A pipeline would be required to transport water off of National Forest land on Pole Mountain, instead of allowing additional water to be released into Middle Crow Creek, to avoid channel damage and fish habitat loss. The Stage I diversion structures in the North Fork of the Little Snake River drainage would be modified to increase the diversion efficiency of that system.

Maintenance and flushing flows would be provided in all Stage I and Stage II streams supporting fish populations in both the Little Snake and Douglas Creek drainages.

Blanket minimum flows would be provided in all non-fishery streams to maintain riparian habitat and seasonal reproductive use by trout populations.

Additional area would be disturbed between the reservoir and Hog Park by both pipeline and powerline to operate the pumping station. There would be approximately 450 acres of terrestrial wildlife habitat which would not be mitigated as a result of constructing the lower reservoir and increasing the surface area of Rob Roy and Hog Park Reservoirs.

This alternative would comply with the state and county land plan goals and would provide for positive resolution of many identified public issues.

Alternative E.

This alternative would eliminate most impacts on National Forest Lands. It would combine water conservation, purchase of agricultural water rights and groundwater development. Water conservation could reduce the need by 5,100 1/ acre-feet. There would be 8,000 acre-feet gained by purchase of agricultural water rights and 5,000 acre-feet would be gained from groundwater development for a total yield 13,000 acre-feet.

Alternative E is the least expensive of the action alternatives to construct. It has an annual energy cost of from $220,000 to $759,000 (depending on whether shallow or wells are used). This energy cost would be absent in all other alternatives except D. This alternative could supply Cheyenne beyond 2070 depending on the extent of water conservation practices. At the current rate (242 GPCD) this supply may last until 2012, depending on actual growth (Graph II-1, p. 55). Costs to the consumer would be more than double the current rate. There would be no change in the current salinity concentrations in the Colorado River system with no water being extracted from the Little Snake River drainage. Current water quantity and quality conditions would remain.

There would be no collection system built, as in Alternatives B and C, in the Little Snake River Drainage. Hog Park and Rob Roy Reservoirs would not be increased in size. The impacts on the Colorado River cutthroat streams and other trout producing streams in the Sierra Madre Mountains would not occur. The impacts of inundating riparian habitat, campgrounds, and 9.7 miles of productive trout habitat associated with reservoir enlargement would not occur.

Construction would be limited to installing a pipeline from Rob Roy Reservoir to Granite Reservior and developing the Lake Creek collection system in the Medicine Bow Mountains. Most of the mitigating measures would not have to be applied, reducing mitigation costs borne by the CBPU. There would be maintenance and flushing flows in newly diverted streams in the Lake Creek drainage.

1/ The 5,100 acre-feet is an average estimate resulting from a 10% reduction in use, per decade over a 30 year period.

There would be no reinstatement of trout habitat units lost in previous Stage I diversions. Douglas Creek would continue to have one cfs of bypass flow. An increase of maintenance and flushing flows would not occur. There would be approximately \$304,425/yr. in agricultural production lost.

This alternative would satisfy all but the water development aspects of state and county plans. It would resolve all issues connected to the adverse environmental impacts surrounding transbasin diversion development. It would not resolve the issues of developing compact allocated water (keeping it in Wyoming), developing current water rights, and providing supplies to other communities. Alternative E could also create side issues related to retiring agricultural land and impacting uses of groundwater aquifers.

Summary of Environmental Impacts

The following table compares Alternatives A, B, C, D, and E. The categories used on this table are identified under "Public Issues" and "Management Concerns" in Chapter I and are found as "Resource Element Impacts" in Chapter IV. The management concerns are derived from the descriptions of the "Affected Environment" in Chapter III.

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ENVIRONMENTAL IMPACTS

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
1. Economics a. Amount of Water Produced for Cheyenne Total/Additional -Acre-feet	14,700 / 0	34,200 / 19,500	30,500 / 15,800	32,700 / 18,000	27,700 / 13,000
b. Cost to Consumer - Rate/1000 gal.-1980 Dollars (Low Use) 1/ - Rate/Acre-foot	$.87 / $294	$2.33 / $790	$2.53 / $858	$4.38 / $1429	$2.33 / $788
c. Cost to Consumer - Rate/1000 gal.-1980 Dollars (High Use) 2/ -Rate/Acre-foot	$.60 / $203	$1.61 / $545	$1.74 / $592	$3.01 / $981	$1.61 / $543
d. Cost to Cheyenne -Rate/1000 gal.-1980 Dollars -Rate/Acre-foot	$.29 / $97	$1.16 / $393	$1.26 / $427	$2.18 / $711	$1.16 / $392
e. Project Construction Costs -1980 Dollars	0	$100,355,000	$83,346,000	$138,543,000	$53,453,000
f. Annual Maintenance Costs Do Not Include Annual Special Use Fees -1980 Dollars	$50,000	$126,500	$114,500	$2,405,000	$1,102,200
g. Forest Service Administrative Costs Construction Monitoring -1980 Dollars	0 / $620	$62,000 / $990	$57,000 / $990	$37,200 / $774	$15,000 / $700
h. Electrical Power Consumed - Killowatt Hours	14,700	14,700	14,700	33,320,000	5,514,400
i. Term of Supply at Current Consumption Rates High Growth Rate -Without Cons. / -With Cons.	1980 / 1981	2010 / 2039	2004 / 2027	2008 / 2027	2000 / 2018
Average Growth Rate -Without Cons. / -With Cons.	1980 / 1983	2032 / 2070+	2022 / 2070+	2028 / 2070+	2015 / 2070+
Low Growth Rate -Without Cons. / -With Cons.	1982 / 2040	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+
2. Resource Management a. Watershed 1) Riparian Habitat -Acres Lost/Net after Mitigation	(-) 0 / (+) 0	(-) 454 / (-) 354	(-) 454 / (-) 354	(-) 459 / (-) 359	(-) 0 / (+) 0
2) Salinity Increase Range - mg /liter (Colorado River at Imperial Dam)	0	1.89 - 2.17	1.53 - 1.76	1.89 - 2.17	0
b. Fisheries 1) Game Species Existing	4	4	4	4	4
2) Trout Streams Diverted	0	13	11	4	4
3) Miles of Stream - Lost - Net miles after Mitigation	(-) 0 / (+) 0	(-) 9.7 / (-) 5.1	(-) 9.7 / (-) 5.1	(-) 14.6 / (-) 10.0	(-) 0 / (+) 0
4) Total Stage II Trout Habitat Units -Lost -Net Habitat Units after Mitigation	(-) 0 / (+) 0	(-) 484 / (+) 15	(-) 457 / (+) 40	(-) 1138 / (-) 627	(-) 18 / (+) 221
5) Colorado River Cutthroat Trout 3/ -Habitat Units Lost -Net Habitat Units after Mitigation	(-) 270 / (-) 270	(-) 291 / (-) 39	(-) 291 / (-) 39	(-) 270 / (-) 18	(-) 270 / (-) 270
6) Stage I Trout Habitat Units -Lost Due to Inadequate Streamflows -Regained by Providing Streamflows	(-) 811 / (+) 0	(-) 811 / (+) 811	(-) 811 / (+) 811	(-) 811 / (+) 811	(-) 811 / (+) 0
c. Recreation 1) Potential Dispersed Recreation Change Semi-Primitive to Rural - Acres	0	8,400	6,300	2,700	0
2) Developed Recreation Sites Displaced and Relocated - PAOT	0	375	375	375	0
d. Wilderness Potential 1) Acres Available	67,322	62,112	65,892	67,322	67,322
2) Character Rating	0	(-) 24	(-) 9	(-) 1	0

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
e. Soils 1) Surface Disturbance -Acres	0	2,675	2,552	3,079	340
2) Mass Land Failure Potential (Can be Mitigated by Design) -Acres	0	714	150	740	0
3) Areas of Very Low Revegetation Potential -Acres	0	587	320	500	0
f. Range - Grazing Capacity - AUM's Lost	0	447	408	455	0
g. Terrestrial Wildlife 1) Game Species Present Number of Species	17	17	17	17	17
2) Nongame Species Present Number of Species	230	230	230	230	230
3) Habitat -Acres Lost -Net Acres after Mitigation	(-) 0 / (+) 0	(-) 1078 / (-) 78	(-) 992 / (+) 8	(-) 1449 / (-) 449	(-) 0 / (+) 0
4) Consumptive Use - User Days	1,100	2,500	2,500	1,100	1,100
5) Nonconsumptive Use - User Days	100	300	300	100	100
h. Threatened or Endangered Fish Species - Present Downstream	3	3	3	3	3
i. Visual Resources - Acres of Outstanding Quality Altered	0	493	493	293	0
j. Tree Resource - Acres Lost	0	532	450	764	110
k. Transportation - New Road Construction - Miles	0	29.6	22.7	15.7	11.9
l. Cultural Resources - Acres Needing Survey	0	2,675	2,552	3,079	340
3. State-County Plans a. State Plans 1) Meets Goals Land Plan	100%	100%	100%	100%	100%
2) Meets Goals Water Plan 4/	0%	97%	80%	90%	0%
b. County Plans 1) Meets Goals Land Plan	100%	100%	100%	100%	100%
2) Meets Goals Water Plan	0%	100%	87%	100%	0%
3) Domestic Water Use	0%	100%	87%	100%	30%

1/ Low Use = Primarily residential use of less than 250,000 gallons per month.

2/ High Use = Primarily commercial use of more than 250,000 gallons per month. .60/100 gal. is charged after 250,000 is reached

3/ Habitat units for Colorado River Cutthroat Trout are cumulative for Stage I and Stage II because of the "Sensitive" status of this subspecies in Wyoming and because the North Fork drainage is essential to its continued existence.

4/ Full development of unobligated surface water supplies would equal 100%.

○ DOES NOT RESOLVE ISSUE

◒ POTENTIAL TO RESOLVE ISSUE AT LEAST PARTIALLY (50%)

● POTENTIAL TO RESOLVE ISSUE TOTALLY

4. Potential to Resolve Public Issues 1/

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
a. Alternative Water Sources to Stage II	●	○	○	○	●
b. Increased Stream Flows	●	◒	◒	◒	●
c. Decreased Stream Flows	○	●	●	●	○
d. Reservoir Fluctuation	●	◒	◒	◒	◒
e. Colorado River Salinity	●	◒	◒	◒	●
f. New Access into Unroaded Areas	●	◒	◒	●	●
g. Fish Habitat	●	◒	◒	●	●
h. Downstream Water Users	●	◒	◒	●	●
i. Threatened or Endangered Species	●	●	●	●	●
j. Terrestrial Wildlife Impacts	●	○	○	○	●
k. Water Supplies to Other Communities	○	●	◒	●	○
l. Reservoir Safety	●	●	●	●	●
m. Development of Compact Allocated Water	○	◒	◒	●	○
n. Role of Water Conservation Maximized	●	◒	◒	◒	●

1/ Resolution Potential includes mitigation specified for each action alternative.

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I. PURPOSE AND NEED

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I. PURPOSE AND NEED

A. NATURE AND PURPOSE OF ACTION

Because of expanding energy development in Wyoming, the capitol city of Cheyenne has foreseen a considerable increase in population. This population increase would put demands on the municipal water system in excess of present supply. Cheyenne has forecasted demand to exceed supply sometime in the 1980's. Cheyenne has anticipated a negative impact on the quality of life of its citizens if municipal supplies are not increased. The Cheyenne Board of Public Utilities explored other supply sources from the North Platte River, Laramie River, surface water from the mountains near Cheyenne and groundwater. After exploring these alternate sources CBPU selected expansion of the Stage I system which was developed on Medicine Bow National Forest land in 1962.

This Final Environmental Impact Statement (FEIS) describes the CBPU proposed action and alternatives to the proposed action for the Cheyenne Stage II Water Diversion Proposal. Contained within the description is the affected environment and disclosure of the environmental consequences for the proposed action and the alternatives.

An Environmental Impact Statement (EIS) is not a decision document in and of itself. It is a document disclosing the environmental consequences of implementation of the proposed action and alternatives to the proposed action. It is an important document for Federal, State and local governments to use in arriving at their individual decisions regarding the proposed action and alternatives to it.

The environmental consequences on lands and activities administered by other Federal, State and local jurisdictions resulting from the proposed action have been disclosed in this FEIS. Through cooperation, other Federal, State and local jurisdictions have assisted in the disclosure of environmental consequences and development of alternatives to the proposed action.

The Forest Service decision will relate only to lands administered by the Forest Service and will be documented in a Record of Decision. Decisions by other jurisdictions to issue or not issue approvals related to this proposal may be based on the disclosure of impacts available in this document. The disclosure of impacts in this document is also provided for the use of other jurisdictions in their decision making processes. Listed below are agencies cooperating in the preparation of this document and, to our knowledge, the approvals needed by the proponent.

The USDA Forest Service is the lead agency with the following agencies and/or organizations providing specific input to meet the needs outlined in "Cooperating Agencies" 1950.42 of the NEPA regulations. All cooperating agencies participate in the review and comment process used in developing this EIS.

United States Fish and Wildlife Service (USFWS) - Provide data in accordance with the Fish and Wildlife Service Coordination Act dealing with specific aquatic and terrestrial wildlife habitats of national importance affected by the proposal submitted by Cheyenne. In addition to data USFWS will recommend necessary mitigation measures to alleviate specific habitat impacts.

United States Bureau of Land Management (BLM) - Provide data and information on their needs to protect wilderness inventory areas below the National Forest boundary on the Encampment River. The BLM will also supply the information necessary to use this document as a base in issuing pipeline crossing permits on their lands east of the Forest Boundary.

United States Army Corps of Engineers (COE) - Provide data on socioeconomic impacts, wetland areas and special hydrologic data in order to use this document as a basis for issuing their section 404 permits. They will also coordinate with the USFWS to ensure their interagency requirements are met.

Environmental Protection Agency (EPA) - Provide background data in areas of conservation and alternate water supplies to ensure their specific requirements of environmental impacts are sufficiently addressed.

Wyoming Game and Fish (WGF) - Coordinate with the USFWS and USDA Forest Service in supplying and gathering data for specific aquatic and terrestrial wildlife habitats which are of particular concern to the State of Wyoming. They will also cooperate in the development of mitigating measures to alleviate impacts of specific concern.

There are three Federal and five State of Wyoming permits identified as being required for the Cheyenne proposal.

Occupancy Documents - USDA Forest Service - These documents would allow construction and operation of the facilities associated with the selected alternative. They would contain all of the mitigation requirements listed in this Environmental Impact Statement as well as other construction standards, guidelines and requirements. This includes Forest Service Engineering approval of all construction plans. These documents would be issued by the responsible Forest Service official.

404 Dredge and Fill Permit - U.S. Army Crops of Engineers - Section 404 permits, pursuant to the Clean Water Act, are required for the placement of dredged or fill material in waterways, lakes and wetlands. The adjustments of Hog Park and Rob

Roy Reservoirs would require 404 permits for raising the dam. Permits would also be required on any stream having an average annual flow of five cfs or more. A listing of these streams along with the upper limits of jurisdiction is provided below.

Little Snake River Basin

North Fork Little Snake River - West section line, Section 26, T. 13N., R. 85W. (approximate)

West Branch North Fork Little Snake River - Section 19, T. 13N., R. 85W. (approximate)

Roaring Fork Little Snake River - South section line, Section 15, T. 13N., R. 86W. (approximate)

North Platte River Basin

Encampment River - Colorado-Wyoming state line.

South Fork Little Laramie River - junction with unnamed creek, NW¼, Section 15, T. 14N., R. 78W.

Laramie River - Colorado-Wyoming state line.

Sand Creek - Colorado-Wyoming state line, Section 24, T. 12N., R. 75W.

South Platte River Basin

Middle Fork Crow Creek - west edge of Laramie County, Section 18, T. 14N. 70W.

Pipeline Crossing Permit - Bureau of Land Management - a permit would be required to cross land managed by the Bureau of Land Management within the Laramie plains area outside of the Medicine Bow National Forest.

National Pollutant Discharge Elimination System Permit - Wyoming Department of Environmental Quality - This permit would be required for settling ponds needed during the construction phase.

Fugitive Dust Permit - Wyoming Department of Environmental Quality - This permit, if required, specifies control measures for dust during construction.

Direct Flow Appropriation Permits - Wyoming State Engineer's Office - This permit entitles the permit holder to appropriate a specific flow rate for beneficial use.

Permit to Construct a Reservoir - Wyoming State Engineer's Office - This permit allows holder to construct a reservoir and store a specified volume of water.

Enlargement Permits - Wyoming State Engineer's Office - Permits will be required to divert more water and enlarge reservoirs to hold the additional water. A permit is needed to divert more water through an existing pipeline or to add pipelines.

The preparation of this FEIS, disclosing the impacts of the proposed action and alternative actions, is required by the National Environmental Policy Act (NEPA) (CEQ-NEPA Regulations 40 CFR 1500). This FEIS is prepared in the format established in the CEQ Regulations, 40 CFR 1502.10.

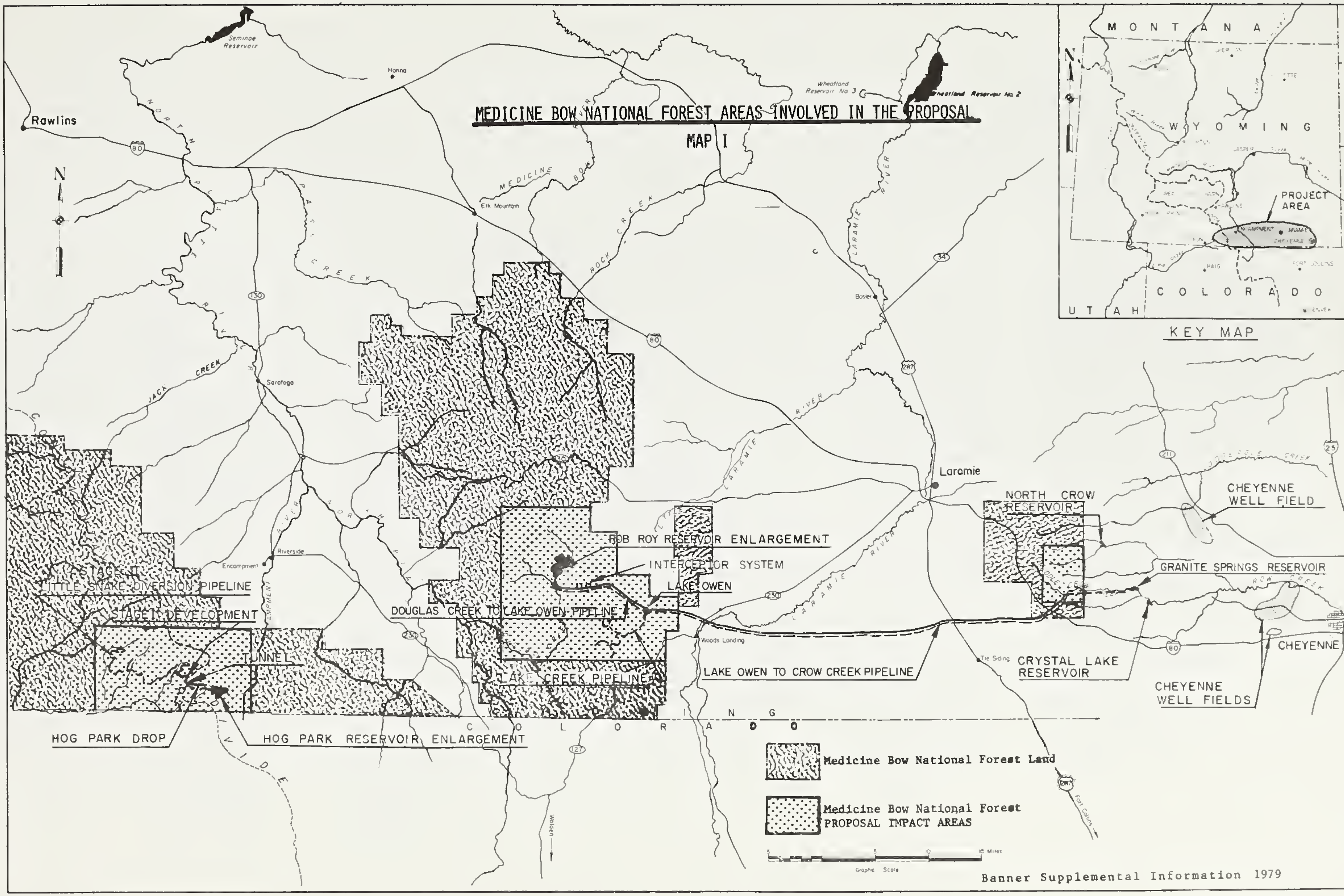
The original Notice of Intent to prepare an EIS was published in the Federal Register on February 6, 1979. A DEIS was issued on May 21, 1980 but was judged insufficient by the Environmental Protection Agency. Also there were additional data received during the comment period that affected the preferred alternative. For these reasons a revised draft was needed. There was a subsequent filing in the Federal Register on September 9, 1980, pertaining to the issuance of a Revised DEIS.

B. VICINITY

The study area encompasses a large portion of southcentral and southeastern Wyoming (Map I, p. 6). Carbon, Albany, and Laramie Counties are located within the study area. The proposal would be built within the Medicine Bow National Forest and along an existing right-of-way between Rob Roy Reservoir and the city of Cheyenne. The terrain varies from flat to rolling rangeland to forested mountain ranges. The mountain areas are remote and are generally inaccessible six months of the year.

The three areas of the Medicine Bow National Forest that are affected by this proposal are: the Sierra Madre Mountains southwest of Encampment, Wyoming; the Medicine Bow Mountains west of Laramie, Wyoming; and Pole Mountain, within the Sherman Mountains, east of Laramie. There are portions of four sections of land managed by the Bureau of Land Management which would be crossed by 2.15 miles of pipeline between Lake Owen and Middle Crow Creek. There would be construction on all three areas. New construction in previously unaffected areas would be found primarily in the Sierra Madre area, consequently the majority of newly affected environments also occur in this area.

There are irrigation water rights in the Little Snake Valley. Some of these rights are on streams below the proposed diversions. There are also irrigation demands on larger streams in Colorado, Arizona, California, Utah and Nevada which have water contributed by the Little Snake River.


MEDICINE BOW NATIONAL FOREST AREAS INVOLVED IN THE PROPOSAL
MAP I
Rawlins
Seminoe Reservoir
Hanna
Wheatland Reservoir No 3
Wheatland Reservoir No. 2
NORTH PLATTE RIVER
MEDICINE BOW
Elk Mountain
PASS CREEK
ROCK CREEK
JACK CREEK
Saratoga
Encampment
Riverside
ENCAMPMENT RIVER
LARAMIE RIVER
Buster
Laramie
Woods Landing
Tie Siding
Fort Collins
Walden
NORTH CROW RESERVOIR
CHEYENNE WELL FIELD
GRANITE SPRINGS RESERVOIR
CHEYENNE
CRYSTAL LAKE RESERVOIR
CHEYENNE WELL FIELDS
ROB ROY RESERVOIR ENLARGEMENT
INTERCEPTOR SYSTEM
LAKE OWEN
DOUGLAS CREEK TO LAKE OWEN PIPELINE
LAKE OWEN TO CROW CREEK PIPELINE
LAKE CREEK PIPELINE
STAGE II LITTLE SNAKE DIVERSION PIPELINE
STAGE I DEVELOPMENT
TUNNEL
HOG PARK DROP
HOG PARK RESERVOIR ENLARGEMENT
DIVIDE
COLORADO
MONTANA
WYOMING
PROJECT AREA
UTAH
KEY MAP
Medicine Bow National Forest Land
Medicine Bow National Forest PROPOSAL IMPACT AREAS
15 Miles
Graphic Scale
Banner Supplemental Information 1979

C. SCOPE OF ISSUES TO BE ADDRESSED

This EIS uses public issues to define disclosure needs in assessing the environmental impacts associated with the Cheyenne Stage II proposal. A public issues is: "A subject or question of widespread public discussion or interest regarding management of National Forest System Programs" (Region Two, Land and Resource Management Planning Field Guide, 1980). These issues, in accordance with NEPA Regulations, Section 1501.7, 40 CFR, were used to establish the scope of the EIS statements.

1. Public Issues: The following issues were identified as a result of comments received at public scoping sessions, as a result of written public response forms distributed at public scoping sessions, as a result of public response to the Huston Park EIS and Land Management Plan, by other Federal and State agency interests, and from comments received on the EIS documents.

   a. Alternative Sources of Water to Stage II

      The Cheyenne Board of Public Utilities (CBPU) proposed action is an expanded gravity flow system similar to that of Stage I. A pumping system has been suggested in the Little Snake drainage and would involve a low elevation reservoir and a pumping station for lifting water into the Stage I system. The Stage I system could be redesigned to collect more of the available water. There is water available for collection that cannot be picked up by current facilities. Exploration of existing well fields in Albany and Laramie Counties has also been suggested. There is a large well at Morton Pass near the west entrance to Sybille Canyon. A third option is the purchase of agricultural water rights in the North Platte Valley or near Cheyenne. Water conservation opportunities and alternate supply methods are discussed in detail in Chapter II.

   b. Increased Stream Flows

      Increased stream flows are of major concern because of their potential effects on stream channels, fish habitat, and wilderness character. Hog Park Creek, the Encampment River, and small streams in the Crow Creek drainage would have increased flows.

c. Decreased Stream Flows

Stage II, as proposed, would reduce flows in thirty streams in the North Fork and Roaring Fork of the Little Snake River drainage. Affected tributaries which contain trout population include: Rose Creek, Third Creek, Deadman Creek, Harrison Creek, Solomon Creek, Rabbit Creek, West Branch of the North Fork, Roaring Fork of the Little Snake and Sherard Creek. A subspecies classed as "sensitive" 1/, the Colorado River cutthroat trout (*Salmo clarki pleuriticus*), is found in the North Fork of the Little Snake River drainage. Flow would be reduced in sixteen streams in the Douglas Creek drainage, including the following which support trout populations in the vicinity of the proposed diversion sites: Nugget Gulch Creek, Little Beaver Creek, Camp Creek, and Lake Creek.

Maintenance flows are needed in these streams to protect existing aquatic habitats. Reduced flows below Stage I diversion structures have had adverse effects on fish populations, and are also of concern to downstream water users.

d. Reservoir Fluctuation

Reservoir fluctuations would occur before and after the recreation season. The recreation season lasts from Memorial Day through Labor Day at Rob Roy Reservoir, and from Memorial Day to November first at Hog Park Reservoir. During the period when heavy recreation use is anticipated, water levels would not fluctuate except to the extent necessary to maintain stable releases in Hog Park Creek and the Encampment River. A drop in water levels would result in mud flats at both reservoirs.

e. Colorado River Salinity

With a reduction in water volume from the collection area in the Little Snake drainage, salinity or dissolved solids concentration in the downstream waters may increase.

1/ Sensitive Species: Those species which (1) have appeared in the Federal Register as proposals for classification and are under consideration for official listing as endangered or threatened species, (2) are on an official State List, or (3) are recognized by the Regional Forester to need special management in order to prevent the need for their placement on Federal or State lists (Forest Service Manual 2670.5)

f. New Access Into Unroaded Areas

There would be some level of access over the entire route of the proposed construction site in the Little Snake River and Lake Creek drainages. The construction between Rob Roy Reservoir and the Forest boundary on Pole Mountain would be within the Stage I area. There could be both temporary and permanent access roads. These roads must be designed for large, highway construction type machinery.

g. Fish Habitat

Stage II, as proposed, would divert water from all remaining streams in the North Fork of the Little Snake River drainage which contain populations of Colorado River cutthroat trout. The streams to be diverted are vital to the existence of this subspecies, so any alterations to these streams must ensure adequate maintenance flows and habitat protection. There would be increased access into relatively isolated habitats which would increase fishing pressure. This fishery is extremely vulnerable to the angler and would probably require special regulations to maintain population levels if proposed Stage II roads are open to the public.

h. Downstream Water Users

There are community concerns regarding availability of water for municipal and irrigation uses along the Little Snake system. The Wyoming State Engineer has determined that there is sufficient water and issued permits to Cheyenne.

The ranchers in the Little Snake Valley are concerned that the CBPU cannot be trusted to operate the system correctly. Past problems have arisen concerning not shutting down collection facilities when called on to do so. The State Engineer's Office states that this is not the case and has required the CBPU to cease collection every time they have been called on to do so. This problem is beyond the mandates of the Forest Service and will have to be resolved on the State level.

i. Threatened or Endangered Species

There are three species of fish (Colorado squawfish, bonytail chub and humpback chub) in the Yampa and Green Rivers that fall into this classification. Their habitat needs are currently under study by the U.S. Fish and Wildlife Service. A no jeaopardy

opinion was issued by the Fish and Wildlife Service on June 1, 1981 (See Appendix I, pp. I-2-10).

j. Terrestrial Wildlife Impacts

The proposal area encompasses a wide variety of wildlife habitat supporting numerous game and non-game species. The effect of this proposal on wildlife species and habitat would range from temporary displacement during construction to permanent loss of habitat due to reservoir enlargement. Big game winter range and riparian habitat found within the proposal area must be given special consideration.

k. Water Supplies to Other Communities

A part of Enrolled Act 43 passed by the 1980 Wyoming legislature stipulates that in return for State loans CBPU will agree to sell excess water to other communities.

l. Reservoir Safety

Residents in Keystone have expressed concern that increasing the height of the dam at Rob Roy Reservoir would increase the possibility of a flood threat to them should it break. There is a history of minor earthquakes in this area.

m. Development of Compact Allocated Water

Stage II, as proposed, would divert water from streams which maintain fish and riparian vegetative habitats. Water is needed to maintain these resources. Concern has been expressed by proponents that the Forest Service is usurping the State of Wyoming right to develop water by requiring maintenance flows in all streams affected by the Stage I and II diversions. State agencies are also concerned that they will lose the opportunity to keep the surface water in Wyoming with increasing downstream demands on the Colorado River system.

An additional facet of this issue concerns payback to the Colorado River System from the Green River. Some Green River water users feel that under the compact they will be losing irrigation water as payback to the lower Colorado River system for the water taken out of the Little Snake River. The State Engineer has determined that this is not the case (See State Engineer letter of 8/13/81, Appendix I, p. I-13).

n. Role of Water Conservation

Water conservation is considered to be necessary in all alternatives to ensure that water supplies (regardless of the amount) remain consistent with established needs. A failure to address this issue resulted in a revised draft. Need for water conservation has been expressed as a concern by some citizens of Cheyenne, residents of the Little Snake Valley, various interest groups, other citizens outside of the immediate area, and the Environmental Protection Agency. Water conservation has been discussed further and combined with groundwater development and agricultural water rights to form an alternative.

2. Management Concerns: A management concern is: "a matter of importance to the management of National Forest System lands, State and Private Forestry and other Forest Service programs which are identified internally by the agency" (Region Two, Land and Resource Management Planning Field Guide, 1980).

The management concerns addressed in this EIS are linked to the public issues, and both provide the basis for formulating the items that need to be fully disclosed. These are the environmental concerns that are disclosed both in text and as line items in Summary of Environmental Impacts table (p. xiv).

a. Effects on Fisheries

This proposal involves streams that are of both regional and national importance as sport fisheries. Stage II expansion would affect fish populations in three mountain ranges in southcentral and southeastern Wyoming. These fish include Colorado River cutthroat trout (*Salmo clarki pleuriticus*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Salmo gairdneri*) in the Sierra Madre Range; brook trout, brown trout, and rainbow trout in the Medicine Bow Range; and brook trout in the Crow Creek drainage on Pole Mountain. Stream, river, and reservoir habitats would be involved, with a various range of effects associated with a change in existing fish habitat due to increased and decreased streamflow, Stage II construction, and reservoir enlargement or establishment. The Colorado River cutthroat trout is of major concern because of its limited habitat; an inability to withstand habitat damage, heavy fishing pressure, competition with other species; and the importance of the North Fork of the Little Snake River drainage to its continued existence.

b. Effects on Recreation

The proposal would impact both developed and dispersed recreation. This impact would extend over the entire parcel of National Forest land that could be involved. Developed recreation sites that could be affected would be those in the vicinity of Rob Roy and Hog Park Reservoirs. Dispersed recreation could be affected by possible changes in roads, trails, stream and reservoir fishing, big game hunting access, other recreation access, and scenic values.

c. Effects on Soils and Potential for Mass Land Failure

A proposal of this type requires ground disturbance if developed. Any ground disturbance increases the potential for increased soil erosion. Factors which contribute to mass land failure such as steep slopes, saturated soils, aspect and sparse vegetative cover, are present within the proposal area.

d. Effects on Range

There would be an impact on forage production as a result of altered natural barriers used for stock control, increased potential for animal-people conflicts, and changed use patterns.

e. Effects on Terrestrial Wildlife

The effects of this proposal on wildlife habitat, big game movement and hunting pressure need consideration. New access into unroaded areas would have to be evaluated with respect to wildlife within the forest.

f. Effects on the Visual Resource

A range of effects on the visual resource from none to extremely adverse could occur. Effects of up and down slope lines are difficult, if not impossible, to mitigate and produce a harsh contrast, decreasing scenic quality.

g. Effects on Tree Covered Area

The tree covered area could be impacted by roads, pipelines and reservoir inundation.

h. Effects on the Cultural Resource

Development of the proposed facilities could entail surface disturbance on several thousand acres,

depending on selected course of action. Much of the area has not been intensively inventoried for cultural or historical resources.

i. Effects on Social Structures

There are two basic lifestyles that could be affected as a result of the proposal. One is the current rural-local community lifestyle represented in the Little Snake River Valley. The second major lifestyle is that of the "city complex" consisting of varied industries, supportive businesses, and residential habitation found in Cheyenne, Wyoming.

j. Effects on Endangered or Threatened Species

There have been concerns expressed about possible effects on three known endangered species of fish in the Yampa and Green Rivers.

k. Effects on Air Quality

This proposal has been reviewed by the Air Quality Division of the Wyoming Department of Environmental Quality (DEQ) and found to be in accordance with the State Implementation Plan as specified in the National Air Quality Act (Appendix III, p. III-47, DEQ letter, Revised Draft Appendix).

II. ALTERNATIVES INCLUDING THE PROPOSED ACTION

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II. ALTERNATIVES INCLUDING THE PROPOSED ACTION

A. OVERVIEW

National Environmental Policy Act (NEPA) Regulations (40 CFR 1502.14) require review and disclosure of all reasonable alternatives to the proposed action, including those not within the jurisdiction of the agency, as well as requiring a no action alternative be rigorously explored and objectively evaluated. The NEPA regulations also require the identification of alternatives eliminated from detailed study and presentation in the EIS.

The alternatives disclosed in this section were generated from public scoping sessions, interagency scoping sessions and other comments received from the public (see Appendix II, pg. II-7, Revised Draft Appendix). Alternatives disclosed in this section are divided into two basic categories; Alternatives Considered and Eliminated From Detailed Study and Alternatives Considered in Detail. Each alternative which has been eliminated from detailed study has been addressed in light of existing information. The reasons for elimination are exhibited in each case. Each alternative which has been considered in detail is compared with other alternatives on the basis of the best resolution of public issues and management concerns. Alternatives previously presented in the May 1980 Draft, but eliminated from further detailed study are also discussed.

The environmental effects of each alternative considered in detail (Alternatives A, B, C, D and E) are displayed in the table, Summary of Environmental Impacts, at the end of this chapter. This table provides a reference to compare the alternatives discussed in detail in Chapter IV.

B. ALTERNATIVES ELIMINATED FROM DETAILED STUDY

1. Cheyenne Board of Public Utilities - Proposed Action

a. General Discussion.

This alternative proposes the development of Douglas Creek water for delivery to Pole Mountain area with replacement water furnished by facilities on the Little Snake, as has historically been the case in Stage I. The potential average annual yield from the proposed Douglas Creek drainage facilities is approximately 28,100 acre-feet (Banner Supplemental Information, 1979). A comprehensive outline of available supplies from Douglas Creek is presented in the 1977 Banner Report on Proposed Expansion of Cheyenne's Douglas Creek Facilities.

The potential yield of the existing Stage I facilities in the Douglas Creek drainage is approximately 13,000 acre-feet per year. Currently 7,400 acre-feet are being used. It is proposed that diversion and storage facilities in the Douglas Creek drainage would be enlarged and expanded to increase the average annual Douglas Creek yield to 27,500 acre-feet. The west slope collection facilities, sized to produce an average annual yield of 27,500 acre-feet, would convey west slope water through the transcontinental divide tunnel and into Hog Park Resveroir.

As proposed, complete development in the North Fork and Roaring Fork of the Little Snake River drainage and in the Douglas Creek drainage would occur. This would include diversion structures on nine fishery and 21 nonfishery streams in the Little Snake River drainage and on four fishery and 12 nonfishery streams in the Douglas Creek drainage. Rob Roy and Hog Park Reservoirs would be enlarged. Additional Stage II water would be released into Hog Park Creek and the Encampment River on a daily payback basis similar to the present Stage I system. Additional Stage II water would be released into the Middle Fork of Crow Creek on Pole Mountain.

Maintenance flows would be provided in Solomon Creek, Harrison Creek, Deadman Creek, the West Branch and Roaring Fork in the Little Snake River drainage. Maintenance flows would not be provided in Rose Creek, Third Creek, Rabbit Creek, Sherard Creek, Ted Creek, Green Timber Creek, the North Fork of the Little Snake, and 21 nonfishery streams in the Little Snake drainage. Maintenance flows would not be provided in Nugget Creek, Little Beaver Creek, Camp Creek, Lake Creek and the 12 nonfishery streams in the Douglas Creek drainage. Douglas Creek flow would remain at one cubic foot per second. Under this proposal there would be a net loss of 2,725 trout habitat units (Complete Habitat Unit Assessment, Appendix IV, Section 2, "Fisheries", Revised Draft Appendix).

A detailed analysis of the water supplies available from an expansion of the Little Snake diversion system is presented in the Banner 1976 Report on Proposed Expansion of Cheyenne's Little Snake Diversion facilities.

b. Proposal Description

1) Stage II Little Snake Diversion Pipeline - Diversion structures would be constructed on

Rose Creek, Third Creek, Harrison Creek, Deadman Creek, Solomon Creek, Rabbit Creek, Sherard Creek, West Branch North Fork of the Little Snake, Roaring Fork of the Little Snake, and several smaller tributary streams in the Little Snake drainage. These facilities would divert runoff from 10,800 acres of watershed for an additional west slope potential water yield of about 20,100 acre-feet (Banner and Associates, 1976). This yield would be potentially available and could provide the maintenance and flushing flows on the following Stage II streams: Solomon, Harrison, Deadman, West Branch, and Roaring Fork of the Little Snake would still be provided.

Maintenance and flushing flows would not be provided on Rose, Third, Rabbit, Sherard, Ted, Green Timber, and North Fork. A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. Pipeline sizes would be 66 inches and 36 inches in diameter respectively (Banner Supplemental Information, 1979).

Approximately 22.7 miles of access road would be required for construction and maintenance. The roads would be located so that the road and pipeline would occupy the same route.

2) Stage II Hog Park Drop - A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir, paralleling the existing pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 225 cubic feet per second (Banner Supplemental Information, 1979).

3) Stage II Hog Park Reservoir Enlargement - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high elevation in the reservoir of 8,640 feet and increasing the reservoir from 175 to 695 acres. The reservoir would impound water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. Replacement

of 3.0 miles of road would be required along the shoreline to provide access to the west slope collection facilities (Banner Supplemental Information, 1979.) Relocation of the facilities at Lakeview Campground plus a new access road would be required.

4) <u>Stage II Rob Roy Reservoir Enlargement</u> - The existing Rob Roy Reservoir on Douglas Creek would be enlarged from 8,895 acre-feet to a capacity of approximately 35,400 acre-feet. This enlargement would require raising the existing earthfill dam 50 feet, and increasing the lake size from 314 to 800 acres. The reservoir would impound runoff from 20.8 square miles of the upper Douglas Creek watershed, have a capacity of 35,000 acre-feet and could maintain an average annual yield of 20,250 acre-feet (Banner Supplemental Information, 1979).

   This yield would be available and provide the required maintenance flow below the Douglas Creek diversion structure. The one cfs maintenance flow on Douglas Creek would not be changed, and no flushing flow would be provided. The proposed high water line of 9,470 feet would cover an additional 487 acres of land. A road 3.9 miles long would be constructed along the shoreline to provide access around the reservoir. The existing boat ramp and campground would be relocated above the new high water line (Banner Supplemental Information, 1979).

5) <u>Stage II Douglas Creek Area System</u> - Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the existing Stage I pipeline, using the existing right-of-way, and ending at Lake Owen. The pipeline would be approximately 58,200 feet long and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information, 1979).

   The existing Horse Creek diversion would produce an average annual yield of about 1,500 acre-feet. Additional instream diversion structures would be constructed on the following tributaries to Douglas Creek: North Branch of Muddy Creek, East Branch of Camp Creek, Middle

Nugget Gulch Branch of Beaver Creek, Gold Crater Creek, and Podunk Creek. Maintenance and flushing flows would not be provided in these streams. The new collectors would gather runoff from 1,380 acres of watershed above the Douglas Creek to the Lake Owen Pipeline and would yield an average of about 1,900 acre-feet per year assuming 80% collection efficiency. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff via gravity to the existing Douglas Creek-Lake Owen Pipeline (Banner Supplemental Information, 1979).

6) Stage II Lake Creek System - Diversion structures and pipelines would be constructed to divert water from Lake Creek, Hay Creek, East Branch of Hay Creek, West Branch of Hay Creek, Joe Creek, H.T. Creek, Banner Creek, and Collins Creek, all tributaries of Douglas Creek. Maintenance and flushing flows would not be provided in these streams. These structures would divert runoff from 3,170 acres of the Lake Creek watershed for an average annual yield of 4,450 acre-feet. The collected water would be delivered to Lake Owen by gravity flow through approximately 73,500 feet of pipeline having a capacity of 30 cubic feet per second. An access road 6.6 miles long would be required for construction and maintenance. The roads, with rights-of-way varying from thirty to seventy feet in width, would be located so that the road and pipeline would occupy the same right-of-way to reduce the total disturbed area (Banner Supplemental Information, 1979).

c. Reason For Elimination From Detailed Study. This action was eliminated from detailed study because it was not environmentally acceptable. It did not meet the alternative formulation criterion of, "Providing for maintenance flows in all diverted streams." It is not considered environmentally acceptable although it would provide for maintenance flows in a portion of the Stage II streams. Rose Creek, Third Creek, Rabbit Creek, and Sherard Creek would not be supplemented thereby eliminating this action from detailed discussion in Chapter IV. Alternative B is a modification of the CBPU proposal with alterations to Stage I and mitigation measures included.

2. Growth Management

Although this option would be acceptable under the formulation criteria, it was eliminated from detailed study

because there are outside influences such as energy development, and regulations that put this alternative primarily in control of the city government and citizens of Cheyenne.

For the purpose of this FEIS, population growth has been estimated using the adjusted 1980 census figures. The most recent growth projections which were available are in Table III-2, p. 108. Growth projections from other sources are in the Revised Draft Appendix, p. III-2. These indicate that Cheyenne's present supply of water should last until 1982, depending on the rate of growth. This is dependent on maintaining the 242 GPCD current consumption rate. If consumption was reduced, present water supplies should last until 2040, assuming a low growth rate of 3% or less annually. Following 2040, the city government of Cheyenne could look to some type of growth management program such as a moratorium on new industry or housing starts if supplies of water were not increased.

3. Weather and Streamflow Modification in Stage I Area

Weather and streamflow modification is currently an experimental science. There are several methods that could potentially be used to increase water yields including cloud seeding, vegetative manipulation, and snow fencing to keep snow in the area. This alternative was eliminated from detailed study because according to a 1978 field study in the proposal area, the heavy forest cover allows little chance to augment streamflow through snow entrapment. Potential yields would increase approximately 500 acre-feet. There is little reason to believe management techniques would be cost effective (Tabler, 1978, Revised Draft Appendix II, p. II-119). There are not enough data on the proposal area to indicate it is feasible to increase water yield through vegetative manipulation.

C. ALTERNATIVES EXPLORED SINGLY AND IN COMBINATION

1. Groundwater

a. General Discussion

Data for the following discussion have been obtained from the Cheyenne Water Project Feasibility Study (WRRI,1979), Reconnaissance Study of the Water Development Potential of the Lower Paleozoic Aquifer, Southeastern Wyoming (WRRI, 1980), Supplemental Information on the Cheyenne Stage II Water Supply Expansion (Banner Associates, 1979), and Effects of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming (USGS, 1980).

There are two aquifer systems in southeastern Wyoming which yield sufficient quantities of water for municipal use, a shallow aquifer system (0-1000' below the surface) and a relatively deep aquifer system (normally from 0-10,000 feet below the surface). The shallow aquifer system is composed of the White River, Arikaree, and Ogallala Formations and the deeper aquifer consists of the Casper Formation. Numerous formations present between these two aquifers do not yield large quantities of water. The following is a discussion of the two major aquifer systems.

1) White River, Arikaree, and Ogallala Formations

These interconnected aquifers comprise the near surface geologic units in southeastern Wyoming. Where saturated, these formations along with occasional overlying floodplain alluvial deposits, are capable of yielding large quantities of groundwater. Cheyenne's existing well field pumps from these formations and has yielded an average of about 3,800 acre-feet per year from 1969 to 1978 (Banner, 1979). Agricultural irrigation is also a major user of groundwater from these formations with 47,300 acres irrigated in 1977 (USGS, 1980). Where extensive well development has occurred, groundwater levels have dropped up to four feet per year (USGS, 1980). However, there are some areas remaining where potential yields are high and little well development has occurred.

2) Casper Formation

The Casper Formation underlies the Cheyenne-Laramie area at depths up to 10,000 feet or more. The Casper Formation is capable of yielding large quantities of good quality water to properly located wells. The best areas are near outcrop areas as shown on Map II-1, Appendix II, pp. II-2 and II-3. These areas are within 2,500 feet depth and yield much better quality water than deeper portions of the formation. Total dissolved solids do not exceed 500 mg/l in these areas. Water in the Casper Formation is confined under high pressure, often resulting in less than 50 feet depth to water after well development.

The Casper Formation has not been extensively developed as a water source because of its great depth. In the Laramie area the City of Laramie, Monolith Portland Cement Company, and

other domestic users use about 4,000 acre-feet per year. Further north, the McGuire well is used for irrigation and more recently the Alcoa well has been outfitted to irrigate. Although water use figures are not available, an annual use on the order of 2,000 acre-feet per year appears reasonable for these two wells.

b. Potential Groundwater Yields

Groundwater yields are difficult to estimate without a boring and pump test program. However, the U.S. Geological Survey computer model of the White River, Arikaree, and Ogallala Formations (USGS,1980) and the Wyoming Water Resource Research Institute recharge estimates for the Casper Formation (WRRI,1980) provide a good indication of potential yields. Estimates of potential yields are discussed in the following sections.

1) White River, Arikaree, and Ogallala Formations

The U.S. Geological Survey computer model of the near surface aquifer in the Laramie County area has been used to predict future groundwater trends. Based on 1971 to 1977 data, the annual groundwater balance in the Laramie County area was as follows:

	Recharge
Total	107,300 Acre-feet/year
	Discharge
Pumpage	43,800 Acre-feet/year
Underflow	73,300 Acre-feet/year
Streamflow	16,400 Acre-feet/year
Total	133,500 Acre-feet/year

The model results show that from 1971 to 1977, discharge was 26,200 acre-feet/year more than recharge resulting in declines in groundwater levels. As development continues, decline in water levels is expected to increase. By 1987, assuming no additional wells added after 1977, total measured declines are expected to reach 30 to 40 feet in the eastern half of Laramie

County. A moratorium on large capacity well development was declared for this area in February 1977.

Although there has been extensive irrigation development in some areas, there has been no development of irrigation wells in the thickest part of the Ogallala and Arikaree Formations located about 15 miles northeast of Cheyenne. It is estithat 5,000 acre-feet per year could be obtained from a well field in this area (WRRI, 1979). According to the U.S. Geological Survey model study, the static water table would be lowered up to 50 feet in 20 years if this well field were to be developed. Since there are no recorded irrigation wells in this area, it appears that only stock wells would be affected. Well field water could be supplied to replace water from any affected wells at limited additional cost to Cheyenne.

A complicating factor to development of this aquifer system would be the filing of about 20 irrigation well permit applications for the potential well field area in 1979 (Banner, 1979). The applications were apparently generated by rumors of expansion of the ground water development moratorium to the whole of Laramie County. Although none of the wells have been constructed, the water rights would have to be acquired or irrigation water provided as replacement for these rights.

2) Casper Formation

Recharge estimates have been made by the Wyoming Resources Research Institute for the areas shown on Map II-1, Appendix II, p. II-2). The areas most advantageously located to Cheyenne are the area west of the Laramie Mountains and the area east of the Laramie Mountains. A third area, the Hartville Hills, is located too far north. The following is a very conservative estimate of the recharge to the two nearest outcrop areas. Neither area encompasses existing Casper Formation uses in the Laramie area and presumably represents new water available. The only significant development is the McGuire and Alcoa irrigation wells.

CASPER FORMATION

Outcrop Area	Direct Infiltration A.F./yr.	Infiltration Stream Losses A.F./yr.	Total
West of Laramie Mountains	9,200	7,800	17,000
East of Laramie Mountains	5,200	0	5,200

In separate studies (Banner, 1979) has estimated that 8,000 to 12,000 acre-feet per year of recharge alone may be available to the Alcoa and McGuire wells located 16 and 28 miles north of Laramie, respectively, in the outcrop area west of the Laramie Mountains.

The Alcoa and McGuire wells are capable of supplying several thousand acre-feet of water as indicated by the results of pump tests. The results are shown below (WRRI, 1979).

MC GUIRE WELL

Test No.	Date	Pumping Period	GPM	Feet of Drawdown
1	7/74	24 hours	750	0
2	1977	48 hours	1200	0
3	4/78	24 hours	3000	6

The static level is 250 feet.

ALCOA WELL

Test No.	Date	Pumping Period	GPM	Feet of Drawdown
1	1975	504 hours	1500	126.82 1/

The static water level is 47.27 feet.

1/ Portion of drawdown due to excessive head loss because of mill slot casing and small casing diameter.

The McGuire well is located along a fracture zone associated with faults while the Alcoa well is located near a fracture zone. Development of new wells strategically located along fracture zones would be expected to result in similarly high yields.

If fully developed, about 22,200 acre-feet of ground water could be obtained from the two outcrop areas of the Casper Formation. However, it would not be practical to attempt to recover all of this water. It would make more sense to develop wells in the easiest to reach and most promising areas first and to progress to less desirable areas later, if necessary.

c. Development of Alternative

From studies described in the previous sections, it appears that there is a good likelihood that the Casper, White River, Arikaree, and Ogallala Formations, if fully developed, could supply sufficient water to serve Cheyenne's foreseeable needs. Groundwater could lend itself well to staged construction with development of the most accessible supplies first followed by development of less accessible supplies as needs develop. Because of geographic proximity and lower pumping energy requirements, the shallow aquifer composed of the White River, Arikaree, and Ogallala Formations 15 miles northeast of Cheyenne would be more economical to develop. For purposes of formulating the ground water component of alternatives, it will be assumed that this source would be developed first. Development of the Casper Formation would be delayed until additional needs arose because of potentially greater well development costs and greater distance to transport the water. Details of the suggested development of the two principal ground water sources are discussed in the following sections.

1) White River, Arikaree, and Ogallala Formations

The Wyoming Resources Research Institute has developed cost estimates for development of 5,000 acre-feet/year from this aquifer system (WRRI, 1979). The details of the design and the cost estimate were updated using the Corps of Engineers' MAPS (Methodology for Areawide Planning Studies)

computer model. The aquifer would be developed with a system of six wells connected to a main pipeline. This pipeline would transport the water to a storage tank northeast of Cheyenne (Map II-2, Appendix II). There would be approximately 20 miles of collection and water transmission pipelines ranging in size from 3 to 18 inches in diameter. There would be one pumping station along the route to transport the water from the well field to the storage tank. Approximately 7 miles of electrical transmission lines would be needed to provide power to the pumps in the well field and to the pumping station. The total construction cost for this option at 1980 price levels is $7,950,000. This includes well pumps and drilling, pipelines, electrical transmission lines, a pumping station, right-of-way, purchase of water rights, and engineering services. The operation and maintenance costs of this system would be $260,000. annually with $220,000. expended for electrical power. 1/

2) Casper Formation

The Wyoming Resources Research Institute has also prepared cost estimates for development of the Casper Formation in the recharge area west of the Laramie Mountains (WRRI, 1979). Their development plan consisted of nine wells from ten miles south of Laramie to 25 miles north. The plan was based on a recharge rate of about 13,400 acre-feet/year, less existing and planned future uses of 6,000 acre-feet/year in the Laramie area, for a net available supply of about 7,400 acre-feet/year. This is a significantly lower recharge rate than determined from subsequent study (WRRI, 1980). The 1979 development plan wells in the Laramie area and to the south could likely have had an adverse effect on yield from Laramie's springs to the south of town.

1/ See Appendix II, p. II-5 for computation of costs for this alternative - Supplied by Army Corps of Engineers.

For purposes of developing the Casper Formation well field component of this alternative, the 1979 WRRI plan was modified to take advantage of now higher estimates of recharge in the McGuire and Alcoa wells area farther to the north. Only the northern portion of the Casper Formation from about ten miles north of Laramie to 25 miles north will be used here. The MAPS computer model was used to prepare a new design and cost estimate for this modified plan. Based on well yields from the McGuire and Alcoa wells it appears that four wells would be sufficient to provide a yield of 6,200 acre-feet/year. The four wells would be connected by pipeline from the McGuire well area to 12 miles south of Laramie, then east along the existing pipeline route from Lake Owen to Middle Crow Creek. There would be approximately 53 miles of pipeline ranging in size from 14 to 20 inches in diamter. There would be two pump stations along the route.

The total construction cost for this option is estimated at $21,632,000. based on 1980 price levels. This includes well pumps and drilling, pipelines, pumping stations, right-of-way, purchase of water rights, and engineering services. The operation and maintenance costs of the system would be $832,000. annually with $759,000. expended for electrical power. 1/

Development of the Casper Formation west of the Laramie Mountains was included here because previous studies had been conducted and the aquifer in the area is a known producer. However, there does not appear to be any reason why about 5,000 acre-feet/ year could not be developed from the recharge area east of Laramie Mountains at similar cost. In fact, the eastern area would probably be less costly overall as there is essentially no pump lift along the conveyance route as opposed to the western area which has in excess of 1000 feet lift. The eastern area has highly ranked sites (See Appendix II, pp. II-2 and II-3), and there are no existing wells tapping the area resulting in no potential for interference.

1/ See Appendix II, p. II-6 for computation of costs for this alternative - Supplied by Army Corps of Engineers.

2. Water Conservation

The objective of water conservation is to make more efficient use of existing water supplies. Water conservation could incorporate a wide variety of specific actions including: structural modifications to the water supply and water use systems, operational changes, revisions of pricing policies, and education of water users. Successful water conservation efforts have generally relied upon a mix of specific conservations programs.

Water conservation programs can be among the most cost-effective approaches for meeting future water demands. Water conservation techniques generally have minimal adverse environmental impacts in comparison with the development of new water supplies. With increasing controversy, competition for new water supplies, and the significant financial burden of developing new supplies; water conservation has taken on new significance.

Water conservation offers unique flexibility as part of a total water management approach in that conservation can be used by itself or in combination with other water supply alternatives. Water conservation programs can effect the need for development of alternative supplies, as well as the size and timing of possible additional developments. For example, conservation in combination with groundwater development may be sufficient to provide for projected water needs even though each individual component by itself would be inadequate. The specific opportunities for water conservation are dependent upon local situations.

a. Potential Conservation Methods

The following methods have produced positive results in water, energy and/or cost savings in other communities (Cole et al., 1978, pgs. 7-14).

1) Encourage the Use of Low Flow Water Devices

Before or during resale of residences low cost devices could be installed in toilets, showers, etc. prior to closing the sale. This could be accomplished through an addition to current city ordinances. Ordinances could also be modified to require low water use devices be used in remodeling. Retrofitted water saving devices can provide an in-house savings

of up to 23% when properly installed in conventional facilities, (Cole, et al. 1978, Appendix II, Section 2, pg. 7, Revised Draft Appendix).

As part of a conservation education program low flow devices could be provided free of charge to customers. Customers could be instructed on proper installation or installation service could be provided. The net water savings would be a benefit to the community.

2) Adopt Regulations to Require the Installation of Water Savings Appliances in All New Construction.

These regulations would become a part of the city building codes and a subsequent requirement for all building permits. Results published in the bulletin "Water Conservation and Reuse" (Cole, et al. 1978, Appendix II, Section 2, p. 7, Revised Draft Appendix), indicate an inhouse savings of up to 35% over conventional devices could be realized. This is the figure for a suburban household of four persons. Certain water saving devices included as a part of dishwashers, clothes washers and shower heads also conserve energy due to a reduction in need for hot water.

3) Pricing Structures to Encourage Savings by Using Less Water.

A progressive pricing structure will place the burden on large-volume water consumers and not on those with low consumption rates. A progressive pricing structure could incorporate base use rates or "life line" rates established as minimum amounts needed to meet the daily demands of a household. Water rates could then be graduated above that amount and a higher fee assessed for excessive consumption beyond the established "life line". Studies conducted between 1963 and 1976 indicate a mean rate of 62.1 gallons per capita per day (GPCD) for each person in a house hold could be used as a basis for life line water needs (Flack and Weakley,

1977, Appendix II, Section 4, p 12, Revised Draft Appendix). This is an in-house rate and does not consider outside uses. This would mean that when a family of four exceeded 7,452 gallons per month the rate would increase (62.1 GPCD x 4 people x 30 days = 7, 452 gallons).

A program in Dallas, Texas resulted in an 8% reduction in water use over the last five years due to the rate structure modification (Cole, et al. 1978, p. 13). It also resulted in a savings to the city by reducing treatment costs for quantities of water that would have to be treated if the program was not implemented.

Rate structures designed to penalize high consumption and waste are in effect in Douglas, Wyoming, where there is a progressive increase in fees as consumption increases (Cheyenne Water Project Feasibility Study, 1979, p. C-58).

4) Ordinances Imposing Penalty for Waste

Ordinances could be enacted to penalize those who waste water. Waste results when lawn watering occurs outside of allowable periods, sprinkler placement causes water to run down pavement, and consumers fail to comply with conservation ordinances. Penalties for these violations could range from a minor fine to a discontinuation of services.

North Tahoe, Nevada instituted a program of fines for noncompliance in the installation of water conservation devices (Cole, et al., 1978). Very positive results were obtained through community cooperation with a reduction in water use of 40% shown during nontourist seasons by public facilities, hotels, motels and ski areas.

Conservation ordinances can be implemented and can meet with customer acceptance if they are implemented properly and if the affected publics are involved in their formulation.

5) Establish Lawn Watering Schedules During Peak Demand Periods

Water consumption can be reduced during summer peak use periods by restrictions on time of day, length of time, or designated days for watering. Similar programs are in effect in areas of the nation where water shortages are commonplace. Results of a three-year study conducted in Wheatland and Laramie show that lawn watering during the summer can account for 55 to 97% of the total residential water use (Kneebone et al., 1979). (See Revised Draft Appendix II, Section 3, p. III-19 through III-24). Restrictive lawn watering procedures during peak periods have a large impact on demands placed on treated water system. A savings here could reduce water consumption and operation costs of treatment systems.

6) Changes in Lawn Watering Systems

Some lawn watering systems help to conserve water better than others. All systems can be made more efficient by installing some type of restrictor in the flow line. Changes in patterns, reduction of watering areas and applicator systems are other methods that could be used to conserve.

In a lawn watering study published by the Wyoming Water Resources Research Institute (Kneebone, et al., 1979) overwatering was measured by determining the depth of deep percolation below the root zone of the grass plants. Results indicate .11 centimeters of deep percolation occurred in Laramie, Wyoming, and .22 centimeters in Wheatland, Wyoming. With an average lawn size 650 square meters and a 140 day season for a city with 11,400 customers, there would be 2.3×10^9 liters or 607,661,800 gallons of water wasted each watering season (Kneebone et al., 1979, p. III-30). The requirement for the grass plants is .46 cm. of water per day. A .22 cm. over-watering means that 6.8 cm. is being applied each day which results in 32% water wastage which could be made available for other uses. By using a moderate 50% overlap the researchers in this study found more acceptable watering results than with the more common 75-80% overlap used by most people. The

latter resulted in over-watering and deep percolation. The study on sprinkler tests revealed that overall, the impact sprinkler performed most economically under each pressure test, while the stationary single hole type used in underground systems used more water to cover the same area. Results indicated that a pulsating or impact sprinkler overlapping by 50% proved to be the most economical in terms of conserving water (Kneebone et al., 1979, p. III-97).

7) Landscaping for Water Conservation

Since the watering of individual lawns, road median strips, and parks accounts for a large proportion of municipal water use, the opportunities for significant water savings through the selection of plant materials and landscape designs are substantial. There is growing interest in using native grasses, ground covers, shrubs, and trees not only for water conservation, but also because of the fact that the native species generally require less maintenance. Landscaping design techniques which include structures and various mulches can also contribute to water conservation. The city of Aurora, Colorado, has recently completed an outstanding booklet on this subject (Joanne Rondon, Landscaping For Water Conservation in a Semiarid Environment, 1980).

8) Recycling and Reuse

Recycling and reuse programs range from using treated effluent for outside watering of open spaces, golf courses, and parks, to recycling treated wastewater for industrial purposes such as cooling water, to more advanced treatment of effluent to bring the water up to drinking water standards. Recycling and reuse methods can be significant components in a water supply/water conservation program.

These methods are feasible and are being implemented in many areas of the country. Examples include Lubbock, Texas, which is using wastewater for crop irrigation. Colorado Springs, Colorado, applies tertiary

treated effluent to college and industrial grounds, a golf course and cemetery, Tuscon, Arizona, uses treated effluent to water parks and golf courses. In Baltimore, Maryland, a steel company uses effluent for cooling and process water. A number of communities in California use treated effluent for groundwater recharge.

As with other water supply/water conservation programs, the potential for recycling and reuse is dependent upon local situations including pattern of water use, nature of wastewater effluent, and legal and institutional factors.

These methods are feasible, yet a complete recycling and treatment process can be quite expensive. Communities can receive 85% federal funding for construction if the program qualifies as innovative (Cole, et al., 1978, Appendix II, Section 2, p. 8, Revised Draft Appendix).

9) Conservation Education Programs

This method could be used effectively to implement any methods previously described. It can also stand alone as a voluntary measure. Some methods successfully used are:

- -Printed inserts included with water bills;
- -community wide poster campaign;
- -bulletins, keychains, matchbook and litter bag messages;
- -public service announcements;
- -speakers and motion picture films presented to various consumer groups sponsored by the utility;
- -help from volunteer groups and service clubs;
- -conservation education programs in local schools (Cole et al., 1978, Appendix II, Section 2, pp. 3 & 4, Revised Draft Appendix).

It would be rather difficult to measure the actual savings from a campaign of this

type but it could be most effective in promoting one or more of the previously discussed methods.

b. Potential Water Conservation Savings

Potential water savings from implementing various conservation techniques are dependent upon local conditions. Important factors which should be considered include existence or lack of water meters; water pricing structure; the mix of residential, commercial and industrial water use; lawn watering in relation to other residential water use; and various legal and institution factors.

Table II-1 gives the range of water savings potential for specific water use categories. Reduction in per capita water use ranges from 20 to 50 percent for various uses. The experiences listed in Section a., Potential Conservation Methods, tend to indicate that substantial reductions in water use could be achieved with no adverse impact on productivity or lifestyles.

TABLE II-1

MUNICIPAL WATER CONSERVATION POTENTIAL 1/

se	Percent Reduction in Each Type of Per Capita Demand	Basis
esidential In-House	25-45	Water saving plumbing and appliances, pressure reducers, meters, and avoid waste.[a]
esidential Outside	30-50	Meters, pressure reducers, drought resistant vegetation, avoid overwatering, and avoid waste.[a]
ommercial	20-40	Water saving devices analogous to residences, self-closing faucets, and avoid waste.[b]
ublic	20-40	Same reasoning as Commercial.[b]
ndustrial	20-40	Wastewater treatment and pretreatment requirements, wastewater user changes, changing water supply rate structures.[b]
osses	20-40	Experience in Oakland, California (Laverty, 1979) and anticipated leak repair in older systems.[b]
eduction in Total unicipal Use:	23-43 percent	
Rounded to:	20-40 percent to be conservative	

OR THE PURPOSES OF THIS ENVIRONMENTAL IMPACT STATEMENT MAXIMUM AVERAGE SAVINGS WILL BE 30%.

/ U.S. Environmental Protection Agency, August 1979, Water Supply-Wastewater Treatment Coordination Study, Report to Congress, Public Comment and Review Draft, p. 218.

a. See Appendix A (EPA, 1979) for detailed support of this estimate.

b. Potential water savings for these categories have not been analyzed on a comprehensive basis in the technical literature. Estimates are the result of extrapolation of the residential estimates and of the limited technical information now available.

c. Cost of Water Conservation Methods

Most water conservation methods tend to have low capital or investment cost as well as minimal operation and maintenance costs. The possible exceptions to this generalization are recycling and reuse systems which may require advanced treatment of wastewater.

One approach to evaluating the cost of water conservation is to calculate the cost of the conservation methods per unit of water saved. This analysis permits comparison of the cost of saving a given quantity of water with the costs of obtaining a comparable quantity of water through some other alternative. Morris and Jones (1980) made this analysis for Denver and the information is summarized in Table II-2.

TABLE II-2
SUMMARY OF POTENTIAL FOR DEMAND REDUCTION 1/

	Savings in Billion Gal.	Fiscal & Consumer Cost per 1000 Gal.	Comments
Meters	9.1	$0.84	Small environmental costs, reduce peak demand.
Shallow-Trap Toilets	5.8	0.04	Reduce sewage treatment, no environmental costs.
Shower Flow Restrictors	3.6	0.14	Reduce sewage treatment, no environmental cost, reduce energy cost.
1000 sq ft Lot Size Reduction	1.1	0.00	Reduce peak demand, unknown environmental costs.
Price Increase with Rebate	15.0	0.29	Not possible without meters, reduce peak demand, small environmental cost.
Leakage Control	2.1	____	Costs in meters contingency fund.
Total Demand Reduction	36.7		Small environmental cost - these costs offset by reduced sewage treatment and peak demand.
Average Cost per 1000 Gal.		$0.35	

1/ Morris and Jones, 1980, Water for Denver, An Analysis of the Alternatives.

It is interesting to note that, according to Morris and Jones, the $0.35 per 1000 gallons saved is far less expensive than any other supply alternative.

Another method used to evaluate the cost of water conservation is listing the water savings and cost associated with common water saving devices. (See Table II, Appendix II, p. II-7).

As was noted previously, the cost of reuse and recycled systems can vary greatly depending upon the effluent to be treated and the use of the treated water. The upper bound for such cost would be bringing wastewater up to potable water quality. Table II-4 (Appendix II, p. II-8) gives the estimated costs of recycled water/potable water systems. In the Denver situation, the costs per 1000 gallons of recycled water is more expensive than other water conservation methods but is comparable to cost of developing other raw water supplies.

d. <u>Water Savings to Cheyenne</u>

Each of the methods discussed in this section has the potential to reduce water consumption, customer water bills and other related energy costs for Cheyenne residents.

The domestic use as calculated for both the 1980 data base and the historical data base 1961-1979 has been found to include residential use, commercial use and non billed uses (golf courses, parks and cemeteries). In the Revised Draft, <u>Cheyenne Stage II</u>, the 124 GPCD (residential use only) was compared to the historical 188 GPCD which revealed a false savings. (CBPU letter of 6/23/81 showing corrected correlations Appendix II, p.II-9).

For the purpose of this discussion, the following figures will prevail and are defined as follows:

- domestic use will include all three categories, residential, commercial, and nonbilled,
- residential will include residential use only (Cheyenne plus south side district),
- commercial use will equal commercial use only,
- nonbilled will include nonbilled use only,
- Industrial use is industrial use only. All Warren Air Base usage will be classed as industrial (CBPU letter of 6/23/81).

Table-II-3 displays the actual GPCD breakdown of 1980 usage based on data contained in the 7/9/81 CBPU letter. Data from 1980 will be used because the 187 GPCD historical domestic use and 188 GPCD 1980 domestic use are nearly identical (Appendix II, p. II-9).

For computation purposes the 1980 population figure will be 53,375 which deletes the Warren Air Force Base population figure of 3,651 from the total. Warren Air Force Base water is also used for parks, green strips, golf courses and other uses on the base which cannot be broken down and separated from residential use. Therefore all Warren Air Base water use has been historically classed as industrial by CBPU and will continue for purposes of this discussion.

To convert the GPCD figure to million gallons per day used (MGD), multiply GPCD x Population and divide by one million: $\frac{242 \times 53,375}{1,000,000} = 12.92$ MGD, Current 1980 Daily Use.

TABLE II-3
CHEYENNE WATER USE

USE	MILLION GALLONS/YR.	GPCD 1/	% of TOTAL 3/
1. Domestic 2/	3655.755	(188)	(78)
2. Residential	2257.009	116	48
3. Commercial	647.352	33	14
4. Industrial	1062.493	54	22
5. Non Billed	751.394	39	16
Total	4718.248	242	100

These MGD figures will be used in the discussion in Section g., Future needs.

1) Use of Flow Devices in Existing Residences

The installation of low flow devices in shower heads and displacement dams in toilets could save approximately 49 gallons daily, 23% per household (Cole et al., 1978). This is a maximum of 49,000 gallons a day savings per 1,000 customers. Based on the data in Table II-1, p. 35, a 30% figure used for Cheyenne would produce a 122 gallon saving per day per household or 122,000 gallons daily per 1,000 customers.

The 1980 residential gallons per capita per day (GPCD) consumption in Cheyenne was estimated at 116 GPCD (Table II-3). The total daily consumption for all uses equals 242 GPCD. If low flow devices provided a savings of approximately 35 gallons per day per resident, this would equal 122 gallons per day per tap, or 44,530 per year. (Cheyenne assumes 3.5 persons per tap.)4/ Were this consumed at the $.87 per 1,000 gallon rate, the consumer could save

1/ Formula for GPCD = Total Gallons Used ÷ [53,375 (population) x 365 (days)].
2/ Includes use categories 2, 3, and 5. Domestic use not figured into totals.
3/ Total equals categories 2, 3, 4, and 5.
4/ Computation: 35 gallons saved per resident x 3.5 residents per household = 122 gallons saved per day.

$39.00 per year less the device cost. The cost of these devices is between 65 cents and four dollars each (Table II-3, Appendix II, p. II-7). Installation does not necessarily require service of a plumber and could be made through local service clubs or homeowners.

Total savings would be dependent on the number of customers participating. Additional savings could be realized if commercial interests such as motels also installed these devices. Further savings could be realized by the city not having to treat the 44,530 gallons per tap.

Table II-5 illustrates how Cheyenne's water consumption compares with other cities. Cheyenne's industrial use is much higher than any of the comparative cities.

TABLE II-4

TOTAL CURRENT DAILY CONSUMPTION

RESIDENTIAL AND INDUSTRIAL

City	1970 Consumption	GPCD Difference Cheyenne & Others	Current Consumption All Uses	GPCD Difference Cheyenne Others	Percent Industrial
Cheyenne, WY	266	--	242	--	31.5
Boulder, CO	181	+85	160	+82	4.5
Aurora, CO	--	--	136	+106	--
National Avg.	150	+116	163	+79	--

+ = Amount by which Cheyenne exceeds the GPCD of other cities.

Figures taken from Water and Related Land Resource Management Study, U.S. Army Corps of Engineers, Omaha District, 1977 (Appendix II, Section 7, pp. 4-5, Revised Draft Appendix), except for Aurora, Colorado, use data which was furnished by Environmental Protection Agency 10/80.

2) Adopt Regulations to Require the Installation of Water Saving Facilities in All New Residences

If this regulation was incorporated in the building ordinances a potential savings of up to 35% or 142 gallons per single family dwelling per day could be realized. This would include water saving toilets, fine spray shower heads, water saving clothes washers, spray on faucets and low water use dishwashers. Based on 30% savings, (See Table II-1), if there was a 142 gallon savings, 142,000 gallons per day per 1,000 new single unit dwellings would be conserved. Savings would be proportionately less for mobile homes, dual family units, townhouse complexes and condominiums. These generally have single bathrooms and smaller size appliances. Consumption in these units would also be reduced by 30%, but the per capita per day savings would probably be less than for single unit dwellings. Tabular data comparing regular to low water use devices are in Appendix II, Section 4, Revised Draft Appendix, (Flack and Weakley, 1977, p. 58).

3) Establish Lawn Watering Schedules During Peak Demand Periods

The water consumption during peak summer water periods is from 30% to 98% higher than the average for periods of time when lawns are not watered. During the peak month of July, lawn watering almost doubles the 775 average acre-foot per month consumption to 1,532 acre-feet. July water use is 47% above the year long average. Base data taken from Summary and Analysis of the City of Cheyenne's Proposed Stage II Water System Expansion, Wyoming State Engineer's Office, 1979, Appendix II, Section 5, p. 17, Revised Draft Appendix.

4) Pricing Structures to Encourage Savings by Using Less Water

The current rate structure for Cheyenne is a declining rate similar to the one used by Elmhurst, Illinois, prior to 1975. Following that year Elmhurst went to a uniform rate independent of consumption volume. They found a small percentage of users had

high demands and were charged accordingly. The high rate structure for large volume users and a conservation program reduced consumption by 15% (Cole, et al., 1978, Appendix II, Section 2, p. 10, Revised Draft Appendix).

Currently CBPU charges a monthly rate which varies from a $4.10 base for a 5/8" meter tap to $50. for a 12 inch meter tap. The 3/4" tap at $4.35 base fee is currently the most common. The water use fee has 4,000 gallons included in the base meter and is $.87 per 1,000 gallons for the next 246,000 gallons. The fee drops to $.60 per 1,000 for over 250,000 gallons (Wyoming State Engineer's Office, 1978, Appendix II, Section 5, p. 18, Revised Draft Appendix). A savings could be realized if an increasing use structure was instituted. Declining rates for increased consumption place a burden on the residential user. If this charge were increased 36% instead of decreased 36%, there could be an additional water use savings of 14% 2/ over water use under existing rates. The actual savings would probably only be realized from consumers like motels, restaurants and industry that use large volumes of water. If these are large volume consumers, they would pay more because they are using more, rather than placing their burden on residential users. Based on the 1980 average per capita per day figure, (116 GPCD) the average household only uses approximately 12,180 gallons per month 1/. They would not be affected by the change. Considering however, that industrial and other commercial and nonbilled uses are 2,461 million gallons (MG) annually (See Table II-3) a 14% savings could amount to a reduction of 344 MG or 1,055 acre-feet per year. All consumers except residential

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1/ 116 GPCD x 3.5 people/household x 30 days/month = 12,180 gallons.

2/ elasticity of demand x 60% increase in price = 14% savings. Calculations are from The Impact of Price on Residential Water Demand and its Relation to System and Price Structure. (Howe and Linaweaver, 1966, Revised Draft Appendix II, Section 8, p. II-83.

exceed the 250,000 gallon per month consumption rate. Savings would be reduced correspondingly as the percent savings reduces.

5) Ordinances for Penalty on Waste

Ordinances placing severe penalties of $500. or more on water waste does result in water savings. North Tahoe, Nevada, showed a 40% savings by hotels, motels and other public service entities during a six month period. Businesses similar to these in Cheyenne could also be covered by an ordinance requiring reduced flow devices installed in their water facilities. Two of the largest motels in Cheyenne use 49.2 million gallons per year (Wyoming State Engineer's Office, 1978, Appendix II, Section 5, pg. 16, Revised Draft Appendix). If restrictions were placed on businesses for six months during a low demand period, a 20% savings could amount to a 4.9 million gallon per year savings. 1/

6) Recycle Water to be Used in Open Spaces

Recycling could be expensive, but with a possible 85% federal grant for innovative projects, this method could prove to be realistic. Current recycling costs are fairly high. A community recycling plant of all waters could be used to furnish a portion of the water used by Husky Oil, Cheyenne Country Club, the Municipal Golf Courses and manufacturing companies. Implementation costs could be borne by all the industrial and municipal users, and cheaper water in return would be an incentive to participate.

Recycling would also include the entrapment or storage of waste water from the city storm drain system. Storm waters would probably have to be pumped and stored.

1/ MG used x .5 (6 months) x 20% = gallons saved, i.e. 49.2 x .5 = 24.6 x 20% = 4.9 MG.

7) Changes in Lawn Sprinkling Systems

The adaptation of efficient sprinklers on city systems and recommendations to customers could produce a real water savings. The WRRI "Water Requirements for Urban Lawns" study indicates a large difference between the amount of water used by the impact sprinkler and the stationary types. Under a moderate pressure of approximately 20 pounds per square inch, the stationary type applies approximately .8 of an inch per hour, and an impact sprinkler applies .2 of an inch (Kneebone, et al., 1979, Appendix II, Section 3, p. III-97, Revised Draft Appendix).

Shorter watering periods for the excessive use sprinklers can save water. The impact sprinkler waters at .2 inch per hour with a 50% overlap and could produce desired lawn water needs with a reduction of .5 to .6 inches per hour. At least a 50% savings could be realized by the individual user. (The .2 inch per hour sprinkler rate was computed on an area of 490 square feet.)

8) Conservation Education Programs

Conservation education programs could be used by Cheyenne as an effective tool to promote other water saving programs. One public service agency in Colorado is mailing out flow restrictors to retrofit standard appliances. This could be an opportunity for service club projects. Flow devices could be purchased in bulk quantity and distributed free to customers as a public service. The organization could charge a fee slightly above cost but below retail and use this as a money raising project. Another organization could install them as a service project. Combinations and cooperative efforts are unlimited.

Brochures could be put in the monthly water bills suggesting methods to conserve water and the monetary savings that could result. For example, a conservation savings of only five acre-feet per year would render brochure distribution cost effective. Based on current costs, the money saved by not having to process the water would cover the cost of printing the brochures.

Bulletins, keychains, litterbags, etc. are excellent opportunities for service clubs. There is an expense to the club or organization, but many are usually looking for civic projects. Matchbooks could be distributed by restaurants, motels and other public places. The conservation message beside their own establishment's name helps both causes and could prompt owners to purchase the match books as advertising.

Conservation education speakers are sought by local organizations and schools. An effective conservation program with handouts and a film helps program chairman or teacher while furthering the conservation cause. The avenues open to Cheyenne in the field of conservation education are limited only by the imagination of all concerned. Education can be an inexpensive way to promote other water saving methods and it could provide insurance that long term solutions to water and related energy problems are found.

e. <u>Present Water Conservation Programs in Cheyenne</u>

The Cheyenne Board of Public Utilities submitted letters to the Forest Service on July 25, 1980 and July 28, 1980 outlining conservation actions taken. (Those letters are reproduced in full in Appendix II, Section 6, Revised Draft Appendix).

1) One method of conservation which has been presented is metering. All customers using water supplied by the Cheyenne Board of Public Utilities are metered and pay a monthly bill.

2) Water rates to Cheyenne consumers for the first 250,000 gallons are the highest of any major city in the state. This high unit price was considered an incentive for conservation.

3) Adjustments were made in Cheyenne lawn watering schedules. In 1973 the city imposed the following mandated watering schedule:

"Irrigation every other day, odd numbered properties on odd numbered days, even numbered properties on even numbered days.

Watering Hours - 5:00 a.m. to 8:00 a.m.
and
4:00 p.m. to 9:00 p.m.

The net result of this action was "that total water consumption in 1973 increased by 19% over the previous year under the mandatory system." There has, however, been a general decreasing trend in water use since the 1973 high year (WRRI, 1979, Appendix II, Section 1, p. II-24, Revised Draft Appendix).

4) A voluntary conservation campaign was pursued in 1977. The water consumption level for 1977 was approximately 14% lower than the previous year 1976. This reduction was attributed to weekly rains after a dry winter and low reservoir levels that could be observed by consumers. During this period the domestic use dropped from an average of 188 to 163 gallons per capita per day.

5) There are two Cheyenne ordinances dealing with waste of water:

Sec. 44-62. Sprinkling of sidewalks prohibited.

No person shall place a lawn sprinkler, hose or other sprinkler or irrigating device on his premises at such place or in such a manner that the same sprinkles or throws water upon, over or across any sidewalk.

Sec. 44-63. Waste of water prohibited.

No person shall waste water from the city water system, whether the same is metered or not. No leaks in service pipes, connecting pipes or any water fixture shall be permitted. If such leaks are not promptly repaired so as to stop such waste of water, after notice from the Board of Public Utilities, water shall be shut off and shall not be turned on again until such leak is repaired.

6) There are recent policies regarding water conservation in new development.

The Cheyenne Planning Office established policy which all new developments will

have to follow to obtain approval of their development plan:

"<u>Water conservation</u>. The plan should address the need for water conservation in an arid climate.

a) Berms and Runoff. Berms and runoff patterns should be designed to waste as little water as possible. Drainage should be directed to landscaped areas.

b) Sprinkler systems. Consideration should be given to the installation of sprinkler systems in large landscaped areas.

c) Planting materials. The use of planting materials which have a low demand for water should be considered."

7) The Husky Oil Refinery, which consumes 600 million gallons annually, recycles their cooling water 11 times. Husky discharged this water into Crow Creek until 1977 when they built an evaporation pond. Husky is currently evaporating effluent instead of discharging into Crow Creek. Husky brought suit against the State Engineer and the Department of Environmental Quality in 1977 regarding whether the State Engineer or Board of Control had jurisdiction over their change in effluent use. After being heard in the State Supreme Court in 1978, both parties are currently negotiating a settlement.

<u>Summary</u>

During the period of record, 1961 to 1977, the previously described methods of water conservation in Cheyenne have met with varying degrees of success. The trends as presented by the "Cheyenne Water Project Feasibility Study" (WRRI, 1979, Appendix II, Section 1, Revised Draft Appendix) show an overall downward trend in per capita per day water consumption. The total water consumption however, can be anticipated to increase as population increases.

f. Studies on Water Supply/Water Conservation

Two studies on water supply/water conservation have recently been completed for the Denver Metropolitan area. While the situations in Cheyenne and Denver are not completely analogous, there are enough similarities in the conditions that the findings of the Denver studies should be considered in evaluating alternatives for Cheyenne.

Morris and Jones (Water for Denver: An Analysis of the Alternatives, 1980) thoroughly analyzed both the theoretical and actual demand for water, examined alternative sources (from recycling to various additional transmountain diversions) for meeting future water needs, and evaluated policies and programs for implementing water conservation (reducing demand). Included in the assessment of water conservation measures was an anlaysis of metering, water saving devices (shallow-trap toilets and shower flow restricters), lawn size reductions, price changes, rationing or restricting water use, and leakage reduction. These conservation programs were estimated to cost under \$1 per 1000 gallons of water saved. This was substantially less than the cost of water from any other alternative. The basic conclusion of the study by Morris and Jones was:

"Conservation is the cheapest way to provide water for Denver's growth. Policies designed to save water could provide 50 percent of the water Denver will need over the next 30 years at a cost only one-third as high as the cheapest source of a similar amount of new raw water," (Morris and Jones, 1980).

In The Effect of Metering and Price in Attaining Urban Water Conservation in the Denver Metropolitan Area, Flechas (1980) examined water demand, metering, and pricing related to water use in Denver. The findings of this research were very consistent with those of Morris and Jones (1980). Flechas concluded that for every two flat rate residences metered, enough water could be saved to serve one new residence.

While the conditions in Cheyenne and Denver are not identical, the studies by Morris and Jones and by Flechas clearly indicate that water conservation can be a viable, cost effective

method of meeting, at least in part, future water demands.

g. Future Needs

Because increasing water conservation takes time to implement, this section is designed to illustrate possible water savings on a graduated basis from 1980 through 2010. This would allow for start up time and for the methods discussed and exhibited in Tables II-1, II-2, and II-5 to be instituted.

Because there have been several population projections made (Appendix III, Page III-2, Revised Draft Appendix), water savings will be evaluated on the basis of high, low and average growth rates for the 1980-2010 period. This will give a comparative projection and allow for a wider range of possible growth rates.

The reduction in water use rates will be based on 10% savings between 1980 and 1990, 20% between 1990 and 2000 and 30% between 2000 and 2010. Growth figures used are taken from Table III-2. See also pages III-1 to III-5, Appendix III for WRRI population projection methodology.

Table II-6 shows the revised population projections which are based on the percentage increase of the 1980 census less the population of Warren Air Base. The average population in this case is the midpoint between high and low projections. Projections are computed in the Revised Draft.

TABLE II-6

POPULATION PROJECTION

	1980	1990	2000	2010
High	53,375	72,280	97,334	131,427
Low	53,375	57,829	59,594	62,964
Average	53,375	65,054	78,464	97,330

Table II-7 illustrates the total water demand (all users) based on population projection. The 1980 usage is the base which is 242 GPCD. 1990 represents a 10% reduction in use (218 GPCD), 2000 a 20% reduction in use (193 GPCD) and 2010 a 30% reduction (169 GPCD). The MGD figure results from multiplying the population times the GPCD for a specific year.

TABLE II-7

MGD WATER DEMAND WITH CONSERVATION

	1980	1990	2000	2010
High	12.92 MGD 1/	15.75 MGD	18.78 MGD	22.21 MGD
Low	12.92 MGD	12.61 MGD	11.50 MGD	10.64 MGD
Average	12.92 MGD	14.18 MGD	15.14 MGD	16.45 MGD

Table II-8 illustrates the total amount of water, in acre-feet that would have to be supplied by population projection and year.

TABLE II-8

AF/YEAR WATER DEMAND WITH CONSERVATION

	1980	1990	2000	2010
High	14,521 2/	17,639	21,033	24,875
Low	14,521	14,123	12,880	11,917
Average	14,521	15,881	16,956	18,424

With a high population projection and a 30% water savings, Cheyenne would need to develop an additional 10,354 acre-feet of water to meet demand until the year 2010. If the average population projection became a reality then 3,903 additional acre-feet would be needed by 2010. Graph II-1 shows the total period of time water developed from Alternatives A through E would last using each population projection range in

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1/ MGD equals GPCD times projected population for that year.

2/ To convert MGD to Acre-feet per year:

$$\frac{\text{MGD x 365}}{\text{.3249 MG/Acre-foot}}$$

Table II-6. The solid line illustrates the time period without conservation and the dash line with conservation.

h. Conclusions of Water Conservation as an Alternative

The previous sections discussing water conservation are not intended to be the all-inclusive study of a water conservation program for Cheyenne. However, the survey of water conservation opportunities, coupled with the brief review of the water supply and demand situation indicates that water conservation is a legitimate alternative for meeting future needs in the Cheyenne service area.

The available information suggests that substantial water savings could be achieved at minimal costs. In fact, it appears that water conservation programs could provide water for future growth at costs (financial and environmental) significantly below the costs of other alternatives.

Phasing in a moderate conservation program (a 30 percent reduction in per capita water use over a 30 year period) would have little, if any, adverse impact on the area's residents or on the commercial and industrial sectors. It is important water conservation efforts be applied to all water users in the service area.

Water conservation has considerable potential to be an integral component of the Cheyenne water supply/water management program. Water conservation has unique flexibility in that it can stand on its own as well as be used in combination with other water supply alternatives.

In addition to the current water conservation steps practiced in Cheyenne, there are programs which could be explored further:

1) A campaign to retrofit existing water consuming facilities with some type of low flow device (both residential and commercial).

2) Additional regulations which require that low water flow devices be installed in new developments and remodeling of existing structures.

3) Even though the Cheyenne water rate structure is the highest for any Wyoming city surveyed in the 0-250,000 gallon range, an increasing price schedule could be investigated. Previously mentioned studies in Denver, Colorado, North Tahoe, Nevada and Dallas, Texas, indicate that escalating rate structures produce positive savings in water consumption.

4) The existing ordinances limiting waste of water are good, except the planning regulations appear to be more suggestions rather than requirements. They could be made more positive and enforcable.

5) A continuing conservation education program could show positive results. Even though mandated regulations failed in the past, publicity programs during the 1976-1977 drought period yielded positive results in Cheyenne (CBPU letter, July 25, 1980, Revised Draft Appendix II). Good promotional programs could eventually go a long way toward encouraging public acceptance of mandated regulations if consumers understand the need.

6) If new industrial uses of large amounts of water are planned, provisions should be made now for consuming industries to provide recycling of their water before anyone downstream can make a historical use of the additional waste water discharged.

7) Conservation should be a part of any increased water supply to lower the costs to the water users and to decrease the environmental impacts resulting from water development projects including any additional water development for communities that may be using Stage II water.

8) An active conservation program could reduce the demand in 2010 from 23.55 MGD to 16.45 MGD based on an average projected growth rate. At this rate Alternatives B, C, D or E could last beyond 2070, based on an average 6% annual growth rate over 30 years, providing each had graduated conservation applied to it (Graph II-1 and the table which accompanied it, p. 55).

i. Water Conservation as an Alternative

The data in Table II-7 indicate that for all projections, except the low growth rate, Cheyenne water supplies could not extend to 1990 even with a 10% reduction in water use. For the purpose of determining future water needs the average growth rate will be used. With an active conservation program Cheyenne would need an additional 3.53 MGD (3,903 acre-feet per year) to meet projected water needs for all classes of uses. Without water conservation and using water at the 1980 rate of 242 GPCD Cheyenne would need an additional 10.63 MGD (11,942 acre-feet per year). Therefore water conservation could be responsible for saving 8,031 acre-feet of water per year in 2010. Conservation has been expressed in terms of savings for Alternatives A through D, and will be combined with groundwater and agricultural water right purchase to formulate Alternative E, discussed in detail in Chapters II and IV. For the purpose of this document and Alternative E, water conservation will be considered to contribute 4.54 MGD or 5,100 acre-feet per year which would be the savings at 1995 or half way through the 30 year projection period. Water Conservation will be combined with maximum agricultural water rights purchase and groundwater development to provide Cheyenne with 13,000 acre-feet of additional water as a conservative total future supply, and 5,100 acre-feet of less demand.

TABLE II-9

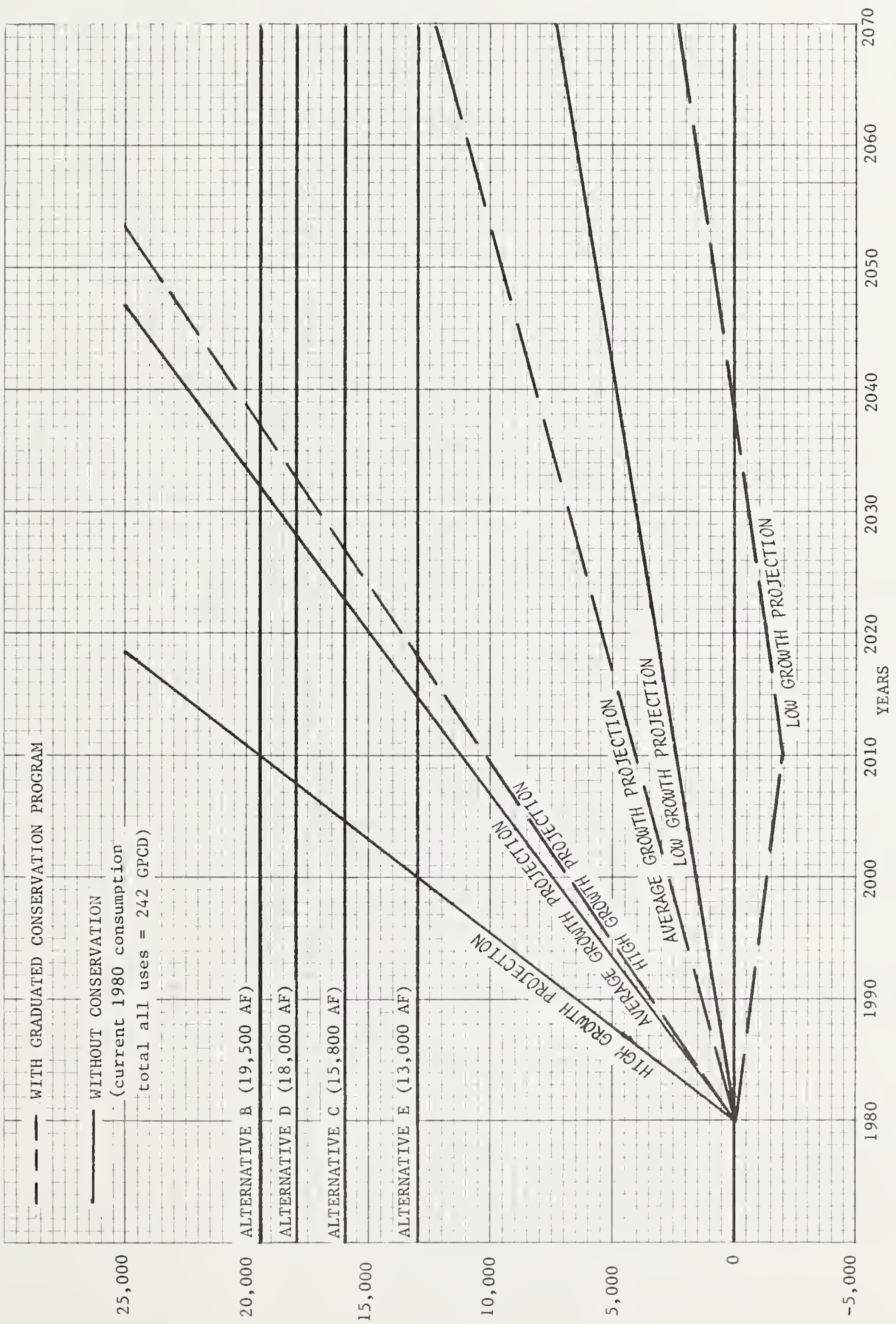
TERM OF ADDITIONAL SUPPLY IN YEARS BY ALTERNATIVE 1/

GROWTH PROJECTION	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
	0	19,500	15,800	18,000	13,000
HIGH	1980 / 1981	2010 / 2039	2004 / 2027	2008 / 2033	2000 / 2018
LOW	1982 / 2040	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+
AVERAGE	1980 / 1983	2032 / 2070+	2022 / 2070+	2028 / 2070+	2014 / 2070+

1/ Data in top of each box is without graduated water conservation. Data in bottom of each box is with graduated water conservation. Figures derived from plotted lines, Graph II-1.

GRAPH II-1

TERM OF SUPPLY BY GROWTH PROJECTION



3. Purchase of Agricultural Water Rights

Purchase agricultural water rights and coverting them to domestic use is a means of resolving water shortage problems for a municipality. Two Wyoming communities, Laramie, by purchasing the Monolith Ranch and Casper by purchasing a ranch near Rock River, Wyoming, in 1980 used this method to either relieve water shortages or provide for future needs.

If Cheyenne purchased water rights in the North Platte River Valley, the water could be used as replacement for their domestic supply taken from the Douglas Creek drainage. Selection of this operation would eliminate the need for developing any of the Little Snake River collection system.

Purchasing agricultural water rights could present at least two options to Cheyenne. First 20,100 acre-feet could be purchased as replacement water resulting in new construction at Rob Roy Reservoir. Additional water collection in the Lake Creek drainage and enlarging the pipeline from Rob Roy to Pole Mountain could deliver 20,100 additional acre-feet of water to Cheyenne.

A second option could be to purchase 8,000 acre-feet, which would result in new construction in the Lake Creek pipeline, and enlarging the pipeline from Lake Owen to Pole Mountain. The 8,000 acre-feet figure was selected since it would allow Cheyenne to use the 4,100 acre-foot excess already being stored in Rob Roy Reservoir. Development of Lake Creek and Douglas Creek tributaries would add 3,900 acre-feet to the total. 1/ The second option could be combined with water conservation and groundwater alternatives in varying amounts to provide the desired amount of additional water for Cheyenne. The agricultural water rights purchase has both benefits and drawbacks which will be discussed in this section.

a. Acquire 20,100 Acre-feet of North Platte Water Rights

1) Detailed Description

Area ranchers could be purchased with both land and water rights for irrigated parcels and transferred to the CBPU. The water rights would be retired from agricultural use and be retained in the North

1/ Conversation with project engineer 8/81.

Platte system for downstream use. Lands associated with the purchase would then be available for dryland operation or disposal, at the discretion of the city. The amount of water purchased would be the regulating factor on how much could be taken from Douglas Creek and transported to Cheyenne. The two systems would have to balance.

According to data gathered, assuming 1.1 acre-foot/acre consumptive use and if 60% of the existing right was proved up on, then approximately 30,500 irrigated acres would be necessary to produce the desired 20,100 acre-feet anticipated for Cheyenne's use (WRRI - Cheyenne Water Project Feasibility Study, p. G-54, Appendix II, Section 1, Revised Draft Appendix).

2) Cost of Acquisition

In the Revised Draft the calculated costs for acquisition were based on two surveyed land transaction prices. The first price was $750./acre and the second $1,000./acre. Cost for 30,500 irrigated acres at these prices would be $28,600,000 and $38,100,000 respectively (Cheyenne Water Project Feasibility Study, 1979, p. E-56 Appendix II, Section 1, Revised Draft Appendix). These figures include legal, engineering and contingency costs.

To convert these costs to a 1980 base, data from the 1980 Farm Real Estate Market Developments Circular 85 was used(Appendix II, p. II-13). Current figures are based on a 13% increase recorded between 1979 and 1980. Estimated current values would now be $848./acre for the low range and $1,130./acre for the high range. Since the original figures are available in the Revised Draft, only the current 1981 figures will be used in this discussion. The current purchase price for 30,500 acres would then range from $32,586,640 to $43,425,900 including legal and engineering fees 1/.

1/ Purchase price includes an additional cost of 26% for the engineering and legal fees.

These costs are for irrigated acres only. Many ranches contain dryland which must also be purchased. This would be a cost in addition to those given. A certain portion of this cost could be recovered by resale. Indications related to recent (1978) land sales in the Laramie area indicate a dryland price of $30-$118 per acre (Doane Appraisal Service, 1978, Revised Draft Appendix II, Section 9, pp. 67-91). The value would range from $34. to $133. per acre (Farm Real Estate Market Developments, USDA, 1980). If a median price of $83. per acre were selected then 30,500 of dryland could sell for $2,531,500. This leaves a net purchase price ranging from $30,055,140 to $40,894,400.

TABLE II-10
SALES INVOLVING DRYLAND AND IRRIGATED LAND IN ALBANY COUNTY
Monolith Ranch Analysis
Doane Appraisal Service, 1978

Dry Acres	Irrigated Acres	Percent Irrigated	Total Acres	Weighted Average
12,415	4,517	36	17,932	$ 71.85
4,956	440	9	5,396	75.20
10,500	1,000	10	11,500	64.00
3,538	690	20	4,228	82.78
5,242	58	1	5,300	80.00
14,920	3,700	25	18,620	107.75

1/ To convert prices to a 1981 base increase all prices by 30%

3) System Development Needs

This option would require Cheyenne to enlarge Rob Roy Reservoir, develop the Lake Creek collection system and enlarge the pipeline from Rob Roy to Pole Mountain to carry an additional 20,100 acre-feet of water. The development costs for this option would be:

a) $35,460,000 Average Net Purchase Price

1/ b) $17,053,000 Expansion of Rob Roy Reservoir

c) $ 5,892,000 Lake Creek Collection System

d) $ 4,906,000 Douglas Creek-Lake Owen Pipeline

e) $22,379,000 Lake Owen-Pole Mountain Pipeline

f) $ 3,671,000 Crow Creek Delivery Pipeline

2/ g) $89,361,000 TOTAL Development Cost

An additional cost that should be considered is that of lost production on those lands involved with the agricultural water rights. Removing water from haylands results in a loss of .55 tons per acre (WRRI, 1979).

Based on the WRRI (1979) data the total loss on 30,500 acres of 60% irrigated land would be 10,065 tons of hay. Hay values averaged $75.00 per ton (information gathered from Platte Valley and Laramie Valley ranches). The production loss would be $754,877 annually.

b. Acquire 8,000 Acre-Feet of North Platte Water Rights

1) Detailed Description

Area ranches could be purchased with both land and water rights for irrigated parcels and transferred to the CBPU. The water rights would be retired from agricultural use and be retained in the North Platte system for downstream use. Lands associated with the purchase would then be available for dryland operation, or disposal at the discretion of the city. The amount of water purchased would be the regulating factor on how much could be taken from Douglas Creek and transported to Cheyenne. The two systems would have to balance.

1/ Cost data for items b-d from pages II-124--II-147, Revised Draft Environmental Impact Statement, Appendix II. Furnished by Banner and Associates, 1980.

2/ Resale of dryland not included

According to data gathered, assuming 1.1 acre-foot/acre consumptive use and if 60% of the existing right was proved up on, then approximately 12,300 irrigated acres would be necessary to produce the desired 8,000 acre-feet anticipated for Cheyenne's use.

2) Cost of Acquisition

The acquisition costs for this option were calculated the same as those for the purchase of 30,500 acres discussed in Section C, Part 3 of this chapter. Based on a varied price of $848. to $1,130. per acre the purchase price would range from approximately $13,142,300 to $17,512,740. These figures include the same legal and engineering fees which are in addition to the prices per acre (Cheyenne Water Project Feasibility Study WRRI 1979, p. E-56 Appendix II Section I, Revised Draft Appendix).

The costs are for irrigated acres only. Many ranches contain dryland which must also be purchased. This would be a cost in addition to those given. A portion of this cost could be recovered by resale of dryland.

Using the same average price of $83. per acre, the 12,300 acres of dryland would sell for $1,020,900. This would leave a net purchase price ranging from $12,121,400 to $16,491,840.

3) System Development Needs

This option would require Cheyenne to develop the Lake Creek collection system and enlarge the Lake Owen - Pole Mountain pipeline to carry the additional 8,000 acre-feet of water.

The development costs for this option would be:

a) $14,307,000 Average Net Purchase Price

1/ b) $ 5,892,000 Lake Creek Collection System

c) $22,379,000 Lake Owen to Pole Mtn. Pipeline

d) $ 3,671,000 Crow Creek Delivery Pipeline

2/ e) $46,249,000 TOTAL Development Cost

The additional cost for this option, relating to lost ranch production from irrigated lands, would result in the loss of 4,059 tons of hay. Assuming the same $75.00 per ton price, production loss would be $304,425 annually.

c) Evaluation of Water Right Purchase as an Alternative

An examination of this option reveals the following:

1) Purchase of North Platte water would cost less than developing the Little Snake collection facilities.

2) Conflicts with downstream water uses could be satisfied in the Little Snake and North Platte systems.

3) Not all water rights would have to be purchased at once, only as Cheyenne needs to call for more water out of the North Platte drainage.

4) There will be production losses in the North Platte Valley as well as lifestyle changes for land owners.

With consideration given to supply in relation to social impacts, the lower figure of producing 8,000 acre-feet will be used in combination with water conservation and groundwater development to provide a possible least cost alternative. See Alternative E discussion in Section E, Part 4 of this chapter.

1/ Cost data for items b-d from pages II-124 - II-147, Revised Draft Environmental Impact Statement, Appendix II - Furnished by Banner and Associates, 1980.

2/ Resale of dryland not included in computation.

D. ALTERNATIVES PREVIOUSLY STUDIED IN DETAIL AND ELIMINATED FROM FURTHER EVALUATION

1. PUMP FROM HOG PARK RESERVOIR TO ROB ROY RESERVOIR. (See Map II-3, p. 65).

a. General Discussion. This alternative proposed to transport water directly from the west slope source to Cheyenne rather than use west slope water for replacement. This would involve the expansion of the Little Snake collection facilities to collect an additional 20,100 acre-feet per year. Improvements would include: extension of the existing diversion system and conveyance pipelines to pick up Little Snake tributaries, construction of a Hog Park drop pipeline, and enlargement of Hog Park Reservoir. Flows released from Hog Park Reservoir would be pumped through a pipeline to be constructed from Hog Park Reservoir to Rob Roy Reservoir and/or Lake Owen.

Under this alternative, the existing facilities on Douglas Creek would be used to produce their maximum potential of 13,000 acre-feet per year. There would be no enlargement of the existing facilities. In order to use the maximum potential of the existing Douglas Creek facilities (13,000 acre-feet per year) it would be necessary to release an equal amount of water into the North Platte system from the Little Snake diversion project. The present rate of releases, which have averaged 7,400 acre-feet per year, would have to be supplemented with an additional release of 5,600 acre-feet per year. This 5,600 acre-feet would come from the expansion of the system described above and would reduce the total quantity available from 20,100 to 14,500 acre-feet per year.

b. Alternative Description

1) Stage II Little Snake Diversion Pipeline - Diversion structures would be constructed on Rose Creek, Third Creek, Harrison Creek, Deadman Creek, Solomon Creek, West Branch North Fork of the Little Snake, Roaring Fork of the Little Snake, and several smaller tributary streams in the Little Snake drainage. These facilities would divert runoff from 12,570 acres of watershed for an additional potential west slope water yield of about 20,100 acre-feet. This yield is potentially available while providing the maintenance and flushing flows required (Appendix II, Table II-9, Revised Draft Appendix).

Two diversion pipelines would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. In addition, 22.7 miles of access road would be required for construction and maintenance. The roads and pipeline would occupy the same route.

2) State II Hog Park Drop Pipeline - A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park drop pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.

3) Stage II Hog Park Reservoir Enlargement - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water level in the reservoir of 8,460 feet. This would increase the reservoir size from 175 to 695 acres. The reservoir would impound the water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. A relocated road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities and access road at Lakeview Campground would be required.

4) Hog Park Creek To Douglas Creek Pipeline, Pump Station, and Booster Station - A pipeline would be constructed starting at the pumping station on Hog Park Reservoir Road, going westerly across the North Platte River Valley to Douglas Creek, paralleling the Boat Creek Road. From the Douglas Creek area, the pipeline would branch to allow water to be pumped into either the existing Rob Roy Reservoir or into Lake Owen. The pipeline to Rob Roy Reservoir would allow the use of the existing Rob Roy Reservoir for storage. The pipeline would be approximately 263,000 feet in length and have a capacity of 40 cubic feet per second. The pipeline would follow the alignment of existing roads to reduce the amount of disturbed area.

A 26 million gallon per day pumping station at Hog Park Reservoir, located upstream of the dam, would be required to lift the water from the reservoir, over high ground near Blackhall Mountain, and into the North Platte River Valley. A 26 million gallon per day booster station would be constructed east of the North Platte River to lift water into the Douglas Creek basin. The pumping station and booster station would be sized to deliver 14,500 acre-feet of water into Lake Owen. The pumping head for the pump and booster station would average 1,425 and 1,095 feet, respectively, or a total pumping head of 2,520 feet.

5) Stage II Lake Owen - Pole Mountain System - An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would start at Lake Owen, cross the Laramie River Valley, parallel the existing pipeline on the existing right-of-way, and end at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline would be approximately 233,000 feet in length with a gravity flow capacity of 26 cubic feet per second.

c. Reason for Elimination from Further Study

This alternative has been eliminated from further consideration because:

1) No public comment in favor of this alternative was received during the review period of the Draft Environmental Impact Statement.

2) Public criticism of this alternative included:

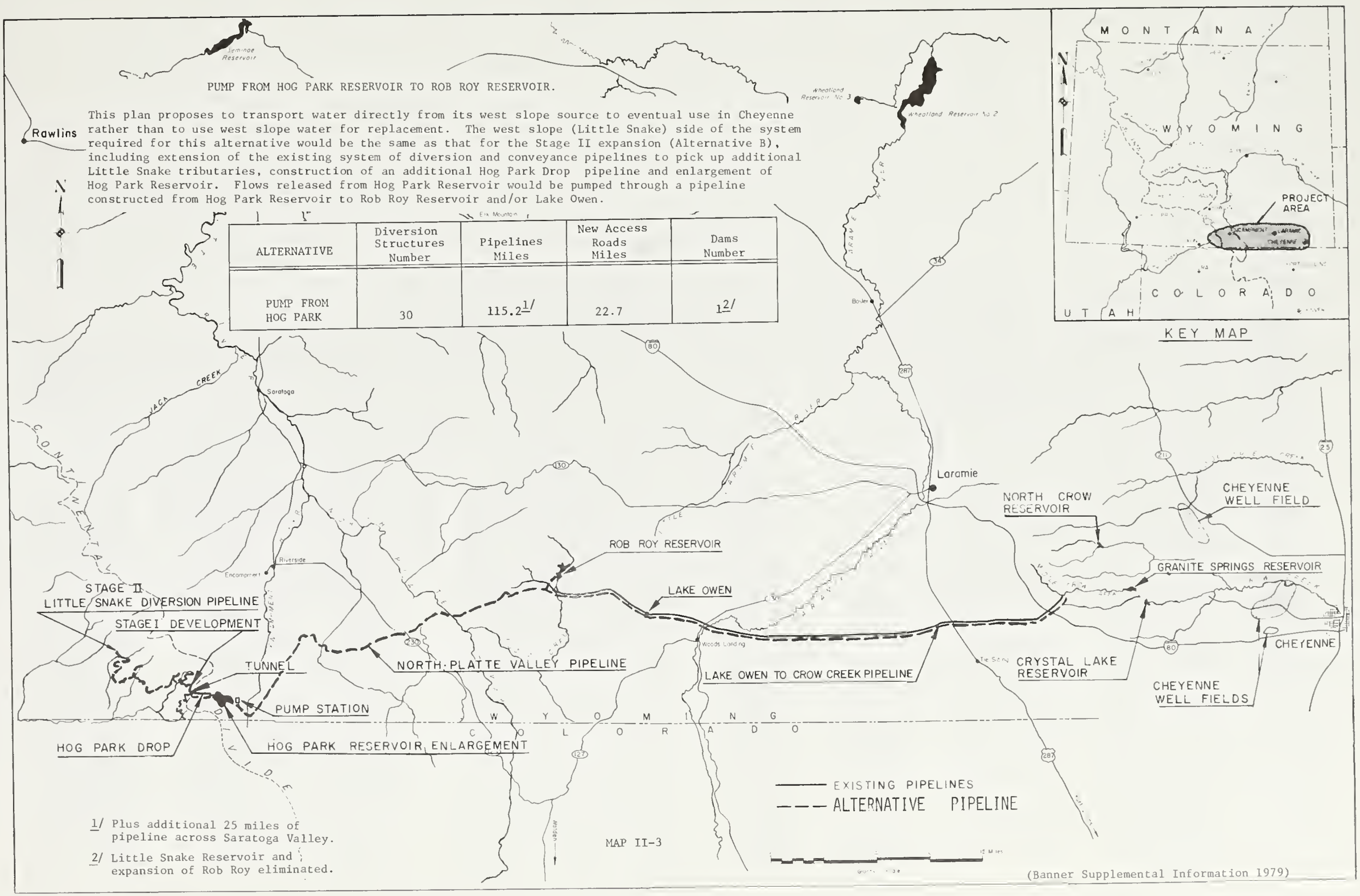
    a) Possible violation of state codes in establishing priority water rights because points of diversion would have to be altered from those listed on the original Cheyenne permit.

    b) The energy consumed and costs involved with this alternative would be prohibitive in terms of current energy conservation ethic.

PUMP FROM HOG PARK RESERVOIR TO ROB ROY RESERVOIR.

This plan proposes to transport water directly from its west slope source to eventual use in Cheyenne rather than to use west slope water for replacement. The west slope (Little Snake) side of the system required for this alternative would be the same as that for the Stage II expansion (Alternative B), including extension of the existing system of diversion and conveyance pipelines to pick up additional Little Snake tributaries, construction of an additional Hog Park Drop pipeline and enlargement of Hog Park Reservoir. Flows released from Hog Park Reservoir would be pumped through a pipeline constructed from Hog Park Reservoir to Rob Roy Reservoir and/or Lake Owen.

ALTERNATIVE	Diversion Structures Number	Pipelines Miles	New Access Roads Miles	Dams Number
PUMP FROM HOG PARK	30	115.2 1/	22.7	1 2/



1/ Plus additional 25 miles of pipeline across Saratoga Valley.

2/ Little Snake Reservoir and expansion of Rob Roy eliminated.

MAP II-3

(Banner Supplemental Information 1979)

2. PUMP FROM NORTH PLATTE RIVER AT BOAT CREEK CONFLUENCE TO ROB ROY RESERVOIR. (See Map II-4, p. 69)

a. General Discussion. This alternative proposes construction of a pump station and pressure pipeline to transport water supplies from the North Platte River to the existing Rob Roy Reservoir and/or Lake Owen. The intake structure for this pipeline would be located near the confluence of Boat Creek and the North Platte River.

Flows diverted from the North Platte River would be replaced with west slope flows diverted from the Little Snake River drainage. Construction of the Little Snake diversion pipeline and enlargement of Hog Park Reservoir would be required.

The existing Douglas Creek facilities would be used to produce the maximum potential of 13,000 acre-feet per year, and there would be no enlargement of these facilities.

The diversion would be designed to pump an average of 14,500 acre-feet per year via pipeline to Middle Crow Creek. The total water to Cheyenne would be 27,500 acre-feet per year.

The flow records of the USGS from the North Platte River at Saratoga, Wyoming (066270) indicate that the flow in the section of river between the proposed point of diversion at Boat Creek, and replacement point at the confluence of the Encampment River, is adequate to maintain senior water right appropriations between diversion and replacement, and still provide the 14,500 acre-feet per year for Cheyenne (Banner Supplemental Information, 1979).

b. Alternative Description

1) Stage II Little Snake Diversion Pipeline - Diversion structures would be constructed on Rose Creek, Third Creek, Harrison Creek, Deadman Creek, Solomon Creek, West Branch North Fork Little Snake, Roaring Fork Little Snake, and several small tributary streams in the Little Snake drainage. These facilities would divert runoff from 12,570 acres of watershed for an additional west slope water yield of about 20,100 acre-feet.

This yield would be available while providing the maintenance and flushing flows required (Appendix II, Table II-9, Revised Draft Appendix). A diversion pipeline system would

begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. In addition 22.7 miles of access road would be required for construction and maintenance. The roads and pipeline would occupy the same route.

2) <u>Stage II Hog Park Drop Pipeline</u> - A pipeline would be constructed from the east tunnel portal to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park Drop Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.

3) <u>Stage II Hog Park Reservoir Enlargement</u> - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water level in the reservoir of 8,460 feet. This would increase the reservoir size from 175 to 695 acres. The reservoir would impound water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. A relocated new road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities and access road at Lakeview Campground would be required.

4) <u>North Platte River to Douglas Creek Pipeline and Pumping Station</u> - A pipeline would be constructed from the North Platte River near the mouth of Boat Creek. The pipeline would follow the Boat Creek Road to Douglas Creek, then parallel the existing Stage I Douglas Creek to Lake Owen Pipeline and discharge into Lake Owen. At Douglas Creek the pipeline would have a branch line to Rob Roy Reservoir. This would enable pumped water from the North Platte River to be delivered to the reservoir and use the existing storage capacity. The pipeline would be approximately 116,200 feet in length and have a flow capacity of 40 cubic feet per second.

A 26 million gallon per day pumping station would be located on the North Platte River near the mouth of Boat Creek. This station would pump from an intake structure on the North Platte River and discharge into Rob Roy Reservoir or Lake Owen through a pipeline. Two 26 million gallon per day booster stations would be located along the pipeline to lift the water from the North Platte River to Rob Roy Reservoir or Lake Owen. The total lift of 2,400 feet would be divided equally so that the pump station and each booster station would operate against an average head of 800 feet.

5) Stage II Lake Owen - Pole Mountain System - An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir and Granite Reservoir. This pipeline would be built, starting at Lake Owen, crossing the Laramie River Valley, paralleling the existing pipeline on the existing right-of-way and ending at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline would be approximately 233,000 feet in length with a gravity flow capacity of 26 cubic feet per second.

c. Reason for Elimination from Further Study

This alternative has been eliminated from further consideration because:

1) No public comment in favor of this alternative was received during the review period of the Draft Environmental Impact Statement.

2) Public criticism of this alternative included:

   a) Possible violation of state codes in establishing priority water rights because points of diversion would have to be altered from those listed on the original Cheyenne permits.

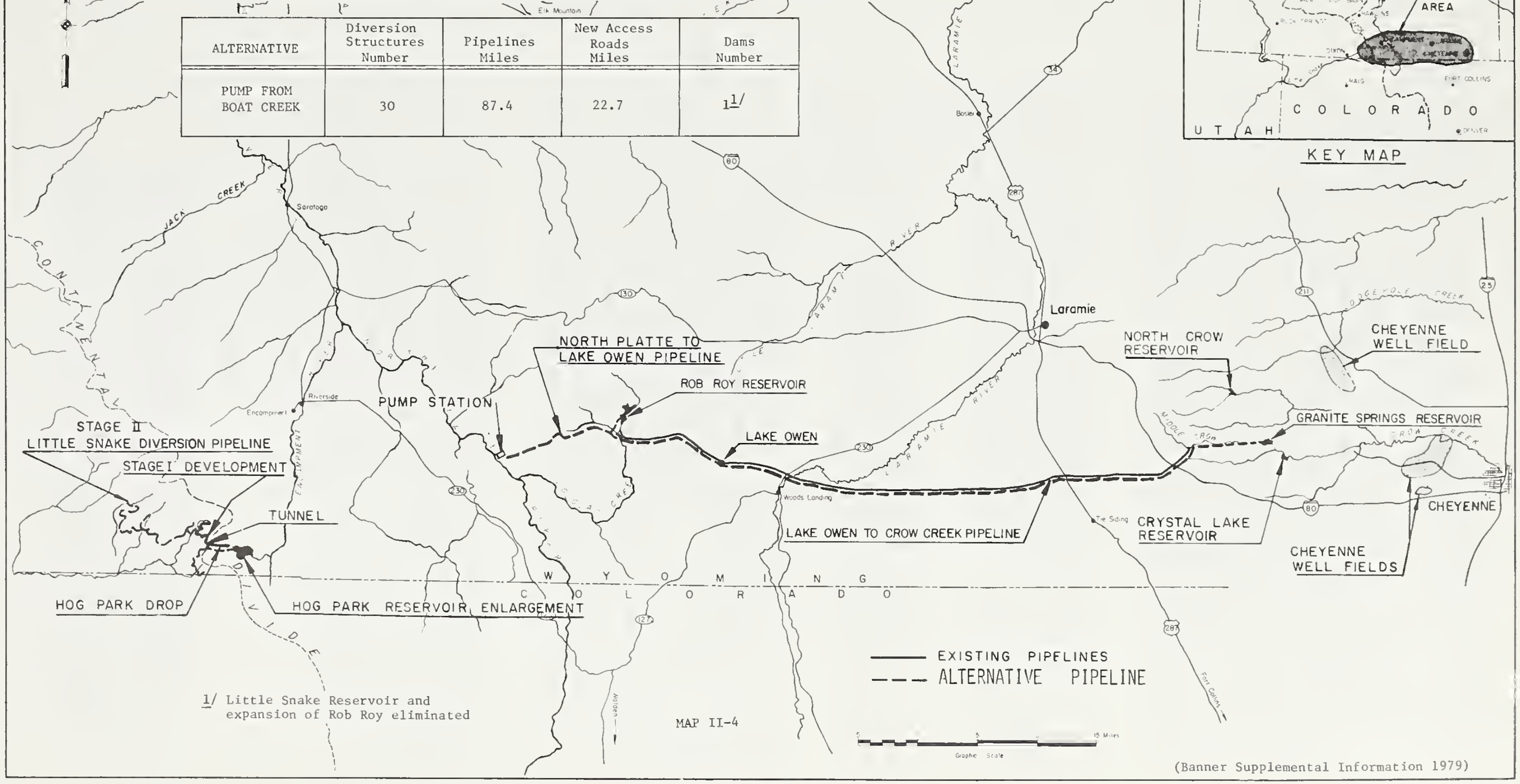
   b) The proximity of necessary pumping stations to the Savage Run Wilderness. The public felt that noise pollution would disturb the wilderness character.

   c) The energy consumed and costs involved with this alternative would be prohibitive in terms of current energy conservation ethic.

PUMP FROM NORTH PLATTE RIVER AT BOAT CREEK CONFLUENCE TO ROB ROY RESERVOIR.

This alternative plan proposes construction of a pump station and pressure pipeline to transport water supplies from the North Platte River to the existing Rob Roy Reservoir and/or Lake Owen. The intake structure for this pipeline would be located near the confluence of Boat Creek with the North Platte River, approximately two river miles downstream from the confluence of Douglas Creek and the North Platte River. Flows diverted from the North Platte River under this alternative would be replaced with west slope flows diverted from the Little Snake River drainage, requiring construction of the Little Snake Diversion pipeline and enlargement of Hog Park Reservoir. The elements of this alternative would be the same as described in Alternative B.

ALTERNATIVE	Diversion Structures Number	Pipelines Miles	New Access Roads Miles	Dams Number
PUMP FROM BOAT CREEK	30	87.4	22.7	1 1/



1/ Little Snake Reservoir and expansion of Rob Roy eliminated

MAP II-4

(Banner Supplemental Information 1979)

3. PUMP FROM NORTH PLATTE RIVER NEAR NORTHGATE COLORADO TO POLE MOUNTAIN. (See Map II-5, p. 73).

a. General Discussion. This alternative proposes to construct a pump station and continuous pressure pipeline diverting water from the North Platte River near Northgate, Colorado and conveying it to Middle Crow Creek. This pipeline would follow the Colorado Highway 127 right-of-way/Wyoming Highway 230 right-of-way to Woods Landing. This pipeline would run parallel to the existing Stage I Lake Owen to Middle Crow Creek gravity pipeline from Woods Landing to Pole Mountain.

Flows diverted from the North Platte River under this alternative would be replaced with west slope flows diverted from the Little Snake River drainage. It would require construction of the Little Snake Diversion Pipeline and enlargement of Hog Park Reservoir.

The existing Douglas Creek facilities would be used to produce the maximum potential of 13,000 acre-feet per year. There would be no enlargement of these facilities.

The diversion that would be constructed on the North Platte River near Northgate, Colorado, would be designed to pump an average 14,500 acre-feet per year via pipeline to Middle Crow Creek. The total water to Cheyenne would be 27,500 acre-feet per year. All water diverted from the North Platte River or from the Douglas Creek drainage would be replaced by releases from the expanded Little Snake system with the corresponding capacity of 27,500 acre-feet per year.

The U.S. Geological Survey stream flow records at the station near Northgate, Colorado (066200) indicate that the flow near the proposed diversion point has historically been adequate during the period of record (1916-present) to sustain a year-round pumping demand of 22 cubic feet per second and a nine month demand of 26 cubic feet per second (Banner Supplemental Information, 1979).

b. Alternative Description

1) Stage II Little Snake Diversion Pipeline - Diversion structures would be constructed on Rose Creek, Third Creek, Harrison Creek, Deadman Creek, Solomon Creek, West Branch North Fork Little Snake, Roaring Fork Little Snake, and several small tributary streams in the

Little Snake drainage. These facilities would divert runoff from 12,570 acres of watershed for an additional potential west slope water yield of about 20,100 acre-feet. This yield is potentially available while providing the maintenance and flushing flows required (Appendix II, Table II-9, Revised Draft Appendix). A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. In addition, 22.7 miles of access road would be constructed and maintained. The roads would be located so the road and pipeline would occupy the same route.

2) Stage II Hog Park Drop Pipeline - A pipeline would be constructed from the east tunnel portal to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park drop pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.

3) Stage II Hog Park Reservoir Enlargement - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water level of 8,460 feet. It would increase the reservoir size from 175 to 695 acres.

   The reservoir would impound water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. A relocated road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground and a new access road would be required.

4) North Platte River to Pole Mountain Pipeline and Pumping Station - A pipeline from Northgate, Colorado, to Middle Crow Creek would be required. The pipeline would start at the pumping station; follow Wyoming Highway 230 to the existing Stage I Lake Owen to Middle Crow Creek pipeline crossing near Woods Landing, Wyoming; then parallel the existing Stage I

pipeline and end on Pole Mountain. The pipeline would have a pressure dissipater to reduce the pipeline pressure through the sag across the Laramie Valley. The pipeline would have a length of approximately 352,000 feet and have a flow capacity of 26 cubic feet per second.

A 17 million gallon per day pumping station, located on the North Platte River near Northgate, Colorado, would be required to lift the water to Pole Mountain. Water would be diverted from the North Platte River through an intake structure. One 17 million gallon per day booster station would be required along the pipeline to lift the water into the Laramie Valley, where gravity flow would tansfer the water down the pipeline past the east boundary of the Medicine Bow National Forest on Pole Mountain. The pump and booster station would operate year-round. The total lift of 1,500 feet would be divided equally so that the pump and booster station would each operate against an average head of 750 feet.

c. Reason for Elimination from Further Study

This alternative has been eliminated from further consideration because:

1) No public comment in favor of this alternative was received during the review period of the Draft Environmental Impact Statement.

2) Public criticism of this alternative included:

   a) Possible violation of state codes in establishing priority water rights because points of diversion would have to be altered from those listed in the original Cheyenne permits.

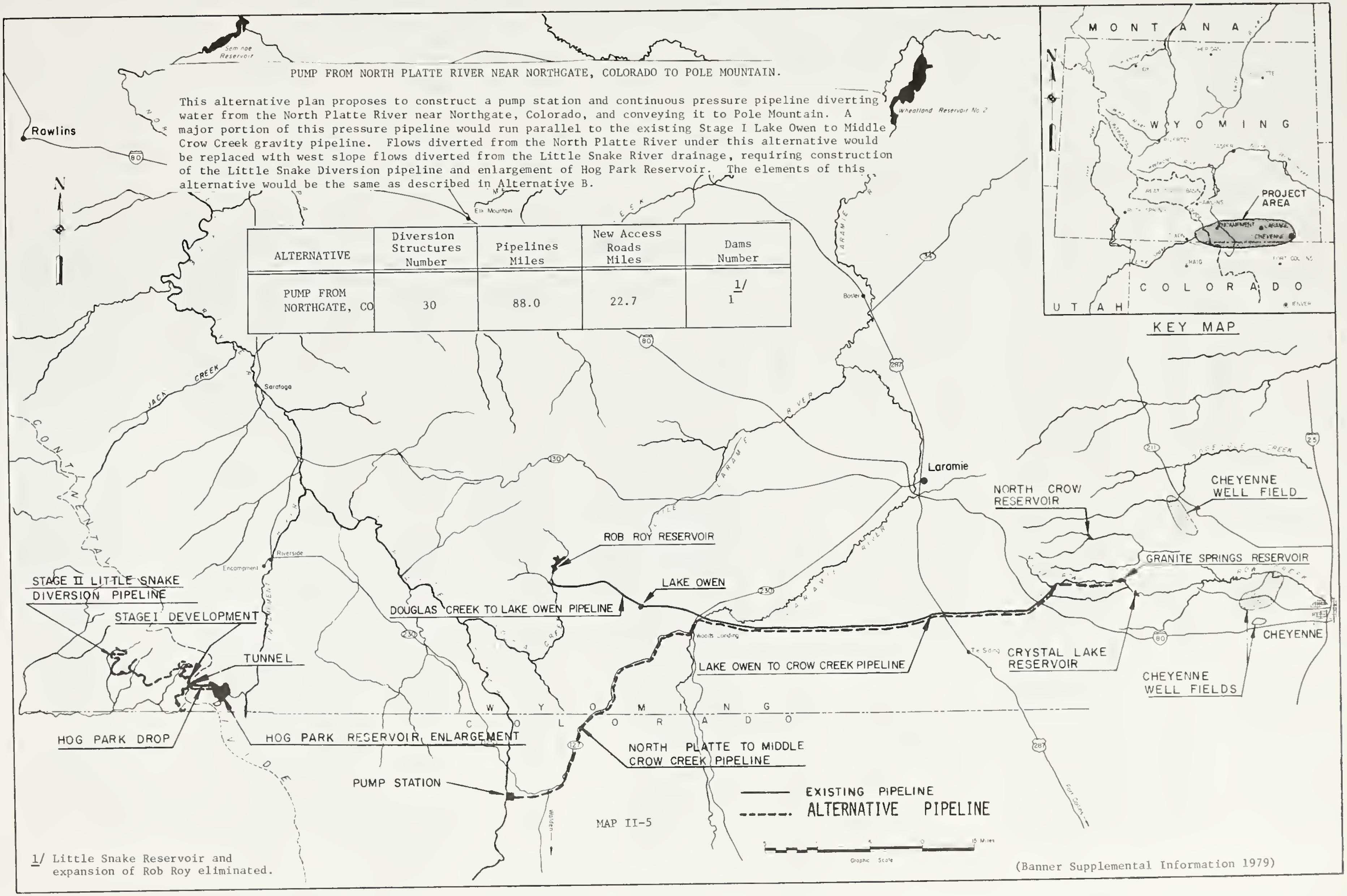
   b) Considerable negotiation would be required between Wyoming and Colorado in order to divert water from Colorado for use in Wyoming. There is no guarantee a transfer could be accomplished.

   c) The energy consumed and costs involved with this alternative would be prohibitive in terms of current energy conservation ethic.

PUMP FROM NORTH PLATTE RIVER NEAR NORTHGATE, COLORADO TO POLE MOUNTAIN.

This alternative plan proposes to construct a pump station and continuous pressure pipeline diverting water from the North Platte River near Northgate, Colorado, and conveying it to Pole Mountain. A major portion of this pressure pipeline would run parallel to the existing Stage I Lake Owen to Middle Crow Creek gravity pipeline. Flows diverted from the North Platte River under this alternative would be replaced with west slope flows diverted from the Little Snake River drainage, requiring construction of the Little Snake Diversion pipeline and enlargement of Hog Park Reservoir. The elements of this alternative would be the same as described in Alternative B.

ALTERNATIVE	Diversion Structures Number	Pipelines Miles	New Access Roads Miles	Dams Number
PUMP FROM NORTHGATE, CO	30	88.0	22.7	1[1/]



MAP II-5

1/ Little Snake Reservoir and expansion of Rob Roy eliminated.

(Banner Supplemental Information 1979)

E. ALTERNATIVES CONSIDERED IN DETAIL

The alternatives disclosed in this section are considered in detail.

Each of the identified alternatives must comply with Section 1502.14 of the CEQ regulations. They are based on those conditions described in Chapter III "Affected Environment" and are ultimately weighed against the public issues and management concerns expressed in Chapter IV, "Environmental Consequences."

The table, Summary of Environmental Impacts, at the end of this chapter ties each of the five alternatives considered in detail to those public issues and management concerns. This table will serve as an aid to reinforce the presentation of each alternative by exhibiting how it resolves the public issues and management concerns.

1. Mitigation Requirements That Are a Part of Alternatives B, C & D

Each of the above alternatives could result in an action to expand CBPU's water collection and transmission system. They will include the following mitigation measures: These measures are in addition to the standard occupancy document clauses specified in the Forest Service Manual. 1/ All measures were developed jointly with all cooperating agencies and the CBPU in attendance. 2/

-All Stage I and Stage II diverted streams would have maintenance and flushing flows to ensure protection of the fishery and riparian habitat (Appendix II, p. II-21, Maintenance Flow Recommendations).

-Fisheries and wetland habitats must be maintained as a part of the Forest Service National programs. The Forest Service was directed by the Chief "where State water laws or water rights adjudication procedures do not recognize instream water use, the Forest Service will utilize, to the fullest extent possible, other existing mechanisms and authorities for the protection of instream needs." Environmental Impact Statements and special use permits are two of the mechanisms by which this directive can be carried out (See Appendix II, p. II-16, USDA Forest Service memorandum re: National Forest System Water Rights, August 2, 1978).

1/ These clauses are available for public review upon request.
2/ Cooperating agency approval is dependent on the inclusion of all mitigating measures in the occupancy documents as well as in the FEIS.

-The South Fork of Middle Crow Creek, and one of its tributaries would be augmented. The amount of augmentation would not exceed eight cubic feet per second (cfs) in the South Fork of Middle Crow Creek, and three cfs in the tributary. Actual amounts will be determined by the channel's ability to adjust to the new flow regime. The water that is not used for instream augmentation would be transported across Pole Mountain by some method other than allowing additional amounts to flow down Middle Crow Creek (Fish and Wildlife Service Coordination Report, 1980, Appendix II, Section 10, Revised Draft Appendix).

-Wildlife habitat loss mitigation measures include fencing 100 acres of potential riparian habitat on Pole Mountain in the Green Mountain Cattle & Horse Allotment. The CBPU would be responsible for construction and maintenance of the fence. The fence would be constructed to keep livestock out of the stream channel except where water gaps would allow livestock to drink and cross back and forth. This fence would be in place until it is determined by the Forest Service, in cooperation with the Wyoming Game and Fish Department, that the stream banks are stable enough to withstand livestock traffic (Fish and Wildlife Service Coordination Act Report, 1980, Revised Draft Appendix II, Section 10).

-A water release system from Hog Park Reservoir must be devised to ensure that Hog Park Creek and Encampment River channels are protected. The wilderness character of the Encampment River RARE II Area (02086) would not be altered. The Hog Park Reservoir Water Release Schedule is found in Revised Draft Appendix II, Section 14, p. II-150.

-Stage II diversion structures must be designed to allow a permanent unadjustable flow to bypass the structures to ensure that required fishery maintenance flows are always provided. This includes diversion structure design which will provide the required fishery maintenance flow prior to allowing water to enter the diversion pipeline. This also includes design which will prevent plugging of the system designed to provide the fishery maintenance flows. If debris enter the diversion structure, they must be channeled into the diversion pipeline and not into the system designed to provide fishery maintenance flows where they could restrict flow. Stage I diversion structures must be modified to meet the above requirement also.

-Rights-of-way would be feathered by selective removal of trees along edges to provide for a softening edge effect and to blend with the landscape instead of having a straight line appearance.

-Wherever possible, roads would be on the same location as the pipeline to reduce construction impacts on the resources.

-Any destroyed facilities such as campgrounds, existing access roads and administrative sites would be replaced in kind by the permittee.

-Any support facilities in association with the construction or operation of the proposed system have to be designed to be compatible with the visual quality of the area.

-All disturbed areas would be revegetated to standards prescribed by the Forest Service.

-Merchantable trees would be harvested and removed from the project area.

-The 340 acres of Cheyenne Board of Public Utilities land would be left undeveloped for wildlife use in perpetuity. This will be accomplished at the time of issuance of the occupancy document by requiring the applicant to provide a surface management easement to the Forest Service or by otherwise encumbering the deed allowing for public and wildlife use. This land is located around Rob Roy Reservoir above the high waterline, and along Douglas Creek between the Rob Roy Dam and the diversion structure. Nondevelopment is in lieu of Cheyenne bearing the cost for treating 500 acres of decadent aspen on the Hayden Ranger District.

-There would be 400 acres of clearcuts seeded to wildlife plant species in locations determined by the Forest Service (in consultation with the Wyoming Game and Fish Department) on the Hayden Ranger District as close as practicable to the affected drainages of the Little Snake River. This will be completed by the time the present reservoirs are enlarged or any new reservoirs are filled.

-There would be 160 acres of decadent aspen treated to induce sprouts for wildlife browse. The CBPU would bear the cost of this treatment. This would be carried out on sites selected by the Forest Service (in consultation with the Wyoming Game and Fish Department) on the Hayden Ranger District in the vicinity of the proposed project. This will be completed by the time present reservoirs are enlarged or new reservoirs, Alternative D, are filled.

-The construction of the Rob Roy portion would have to be contracted and ground work started within five years after the beginning of the Little Snake River section. In accordance with Section 219.11, Item F, of the Department of Agriculture Rules and Regulations (See Appendix

II, p. II-121, Revised Draft Appendix), land uses in the Forest Plan may be continued for a ten year period, but must be re-evaluated after five years to determine whether there is a change in land condition or public need. Any project must conform with the Forest Plan and is therefore subject to the same ruling. If the beginning of the Rob Roy section is delayed past the above period (five years) a new Environmental Analysis would probably be required prior to any construction.

-To decrease disturbance to wildlife, construction activities would be limited to the following time periods:

a) Hayden District - June 22 to September 30
b) Douglas Creek to Lake Owen - June 15 to October 31
c) Lake Owen to east boundary of Sheep Mountain - May 1 to October 31
d) Pole Mountain - June 1 to March 15

Note: The above dates are subject to annual adjustment depending on seasonal conditions. Changes would be approved by the Forest Supervisor, Medicine Bow National Forest.

-New access roads on the west side of the Continental Divide would be closed during the construction period except for administrative use. Additional information would be obtained during the construction period concerning the effects of construction and new access on fish and wildlife populations. This information would be incorporated into road use decisions and into alternatives which may be needed to protect fish and wildlife habitats. Closures of roads following construction would be determined at a later date in consultation with the Wyoming Game and Fish Department (as these closures pertain to habitat management and big game harvest). Slope stability and mass movement information would also be obtained during this period and incorporated into future road use decisions which will be evaluated in the Forest Plan.

-In those areas on the Hayden District where loamy soils are encountered during Stage II road construction or during Stage I road reconstruction, spot surfacing would be required to meet soil loss tolerance limits.

-Reservoir drawdown in excess of that which would occur by following the Forest Service proposed payback schedule would not be permitted during the recreation season. This includes Memorial Day to November first for Hog Park Reservoir and Memorial Day through Labor Day for Rob Roy Reservoir. Fluctuation would be allowed in Hog Park Reservoir to the extent necessary to maintain stable releases in Hog Park Creek and the Encampment River as outlined in a modified release schedule. Such a release schedule would be subject to the approval of the Forest Service.

-Topsoil will be stripped to the depth designated for that soil type and stockpiled in areas that would be designated by the Forest Service prior to any construction.

-A cultural and historical survey will be completed on the project area in accordance with Executive Order 11593, and a release will be obtained before construction begins.

2. <u>Mitigation Requirements That Are A Part Of Alternative E</u>

Due to the reduced construction involved with this alternative the following mitigation measures will be required in addition to standard occupancy document clauses. These mitigation measures have been reduced to be in accordance with the environmental impacts of this alternative.

-There will be maintenance and flushing flows to ensure protection of fisheries and riparian habitats in the diverted streams for Stage II only. These streams are located in the Douglas Creek vicinity. The involved streams and needed flows are listed in Appendix II, p. II-22.

-Stage II diversion structures must be designed to allow a permanent unadjustable flow to bypass the structures to ensure that required fishery maintenance flows are always provided. This includes diversion structure design which will provide the required fishery maintenance flow prior to allowing water to enter the diversion pipeline. This also includes design which will prevent plugging of the system designed to provide the fishery maintenance flows. If debris enter the diversion structure, they must be channeled into the diversion pipeline and not into the system designed to provide fishery maintenance flows where they could restrict flow. Current Stage I flows would not be changed in any diverted stream unless modified by Stage II.

-The water would be transported across Pole Mountain by some method other than allowing additional amounts to flow down Middle Crow Creek.

-Rights-of-way would be feathered by selective removal of trees along edges to provide for a softening edge effect and to blend with the landscape instead of having a straight line appearance.

-Wherever possible, roads would be on the same location as the pipeline to reduce construction impacts on the resources.

-Any support facilities in association with the construction or operation of the proposed system have to be designed to be compatible with the visual quality of the area.

-All disturbed areas would be revegetated to standards prescribed by the Forest Service.

-Merchantable trees would be harvested and removed from the project area.

-To decrease disturbance to wildlife, construction activities would be limited to the following time periods:

a) Douglas Creek to Lake Owen-June 15 to October 31
b) Lake Owen to east boundary of Sheep Mountain - May 1 to October 31
c) Pole Mountain-June 1 to March 15

Note: The above dates are subject to annual adjustment depending on seasonal conditions. Changes would be approved by the Forest Supervisor, Medicine Bow National Forest.

-Topsoil would be stripped to the depth designated for that soil type and stockpiled in areas that would be designated by the Forest Service prior to any construction.

-A cultural and historical survey will be completed on the entire area in accordance with Executive Order 11593, and a release will be obtained before construction begins.

3. Facilities That Differ Among Alternatives

The following explanations briefly describe facilities that would differ among the alternatives. Table II-11 which follows, graphically displays how alternatives A, B, C,D, and E compare on these parameters.

Diversion Structures - These would be structures used to divert water from its natural course into the Cheyenne water system. See figures II-1 and II-2, Revised Draft Appendix II, for conceptual design. All diversion structures would be approved in advance of construction by the Forest Service.

Pipelines - These would be used to gather and transmit the water. They would vary in size. All pipeline designs and locations would be approved in advance of construction by the Forest Service.

Roads - A construction and maintenance access road system would be necessary. Road design would be the minimum necessary to permit the proposed service. Most of the proposed new collection area is unroaded, and access is very limited. Routes could be put on top of the pipeline

to limit land disturbance over a large area. The entire new road system would be on the same rights-of-way as the pipeline wherever practicable. Road locations and design would be approved by the Forest Service in advance of construction.

Dams - There would be dam construction at Rob Roy and Hog Park Reservoirs, or at a new reservoir constructed on the North Fork of the Little Snake River. Neither Hog Park nor Rob Roy Reservoir is presently large enough to store the additional water the proposal would add to the system. The complete plans and specifications would be reviewed by the Forest Service before construction.

TABLE II-11

FACILITIES THAT DIFFER AMONG ALTERNATIVES

ALTERNATIVE	Diversion Structure Number	Pipelines Miles	New Road Access Road Miles	Dam Number
A - NO ACTION	0	0	0	0
B - PROPOSAL WITH MITIGATION	46	99.6	29.6	2
C - MODIFY STAGE I	38[a]	93.1[a]	22.7	2
D - LITTLE SNAKE RESERVOIR	16[b]	78.3	15.7	3
E - COMBINED	16[b]	70.8	11.9	0

KEY

[a]All improvements beyond Standard Creek eliminated.

[b]Douglas Creek diversions only.

4. Alternatives

The Cheyenne Board of Public Utilities proposed action was not considered in detail because Cheyenne did not propose to mitigate unacceptable impacts. It also does not meet the alternative formulation criterion of providing for maintenance flows in diverted streams. The CBPU proposed action is described in Chapter II, Part B of this document.

a. Alternative A - NO ACTION (See Map II-6, p. 84)

With this alternative a permit for development of additional water would not be issued. The CBPU would continue to operate as in the past from their Stage I facility, wells in Laramie County, and from Middle Crow Creek. Their operation would remain status quo, and receive approximately 14,700 acre-feet annually.

Stage II Little Snake Diversion Pipeline - Stage I system would remain as is with no modification or alterations other than those which could be made within the conditions of the existing permit. There would be no additional water development beyond capabilities of the existing facilities.

Stage II Hog Park Drop - There would be no further expansion of this facility. The existing pipeline would remain.

Stage II Hog Park Reservoir Enlargement - The existing Hog Park Reservoir would remain at a capacity of 2,970 acre-feet. There would be no further enlargement of the reservoir and it would remain at 175 surface acres. There would be no alterations in the current operations other than those allowed within the existing permit.

Stage II Rob Roy Reservoir - The existing Rob Roy Reservoir on Douglas Creek would store 8,895 acre-feet covering 314 acres. There would be no further increase in size or alteration in current operations other than those allowed within the existing permit.

Stage II Douglas Creek Area System - There would be no increase in the pipeline system to convey Douglas Creek water to Lake Owen. Additional diversion structures would not be installed on tributaries of Douglas Creek. Stream flows and water depletions would remain at existing levels.

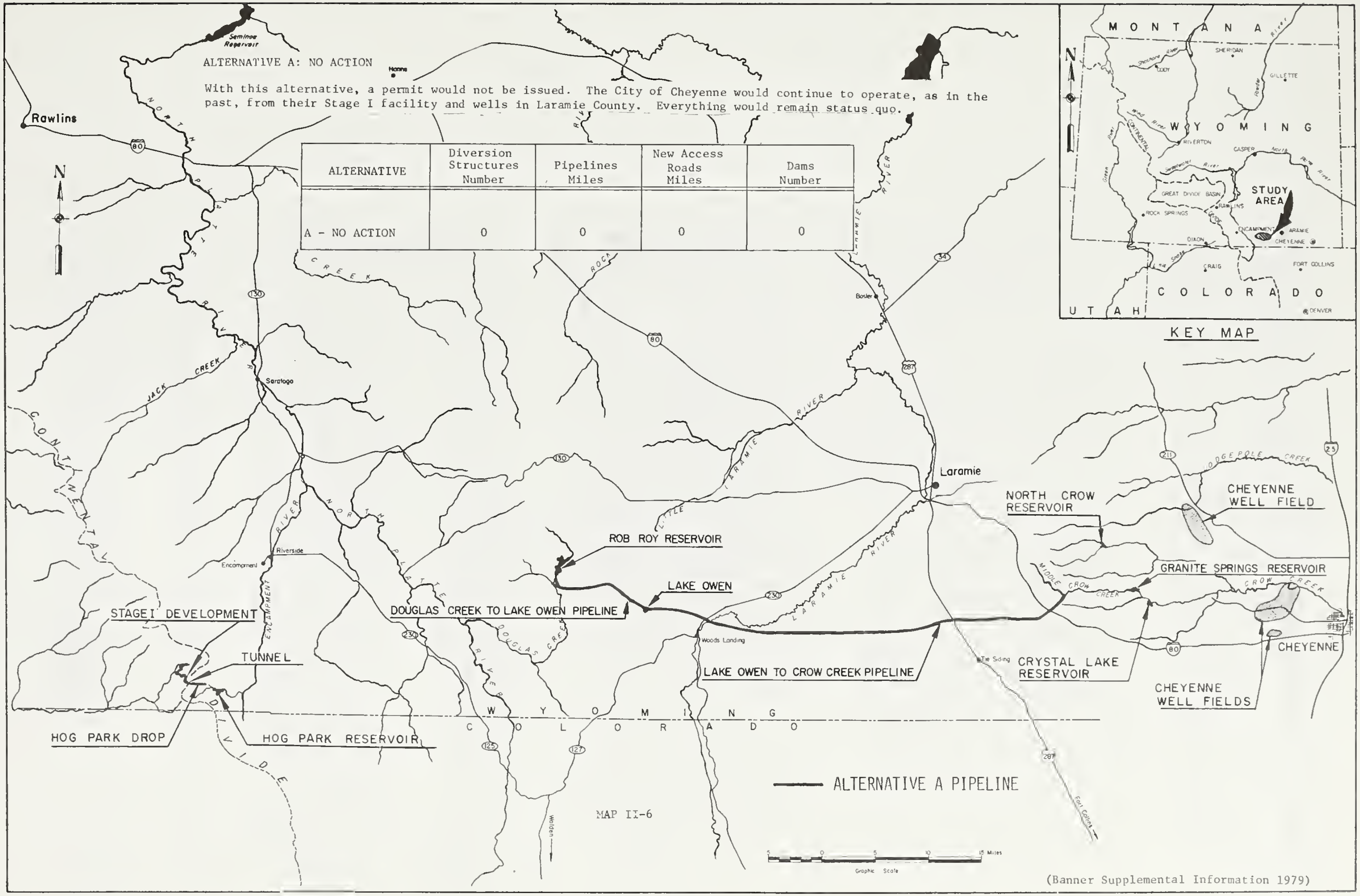
Stage II Lake Creek System - There would be no development in the Lake Creek system. The waters would continue to flow unimpaired into Douglas Creek.

Lake Owen - Pole Mountain System - There would be no additional pipelines added in the current right-of-way. Water would continue to flow through the existing pipeline and empty into Middle Crow Creek on Pole Mountain. There would be no alterations in this segment other than those provided for in the existing permit.

ALTERNATIVE A: NO ACTION

With this alternative, a permit would not be issued. The City of Cheyenne would continue to operate, as in the past, from their Stage I facility and wells in Laramie County. Everything would remain status quo.

ALTERNATIVE	Diversion Structures Number	Pipelines Miles	New Access Roads Miles	Dams Number
A - NO ACTION	0	0	0	0



MAP II-6

(Banner Supplemental Information 1979)

b. Alternative B - PERMIT PROPOSED FACILITIES WITH MODIFICATION (See Map II-7, p. 89.)

Alternative B is the Cheyenne Board of Public Utilities proposed action 1/ with environmental restrictions and mitigation measures added to make it environmentally acceptable.

This alternative would allow all the proposed facilities but with specified mitigation stipulations. Alternative B proposes the development of Douglas Creek water for delivery to the Pole Mountain area with replacement water furnished by facilities on the Little Snake, as has historically been the case in Stage I. The potential average annual yield from the proposed Douglas Creek drainage facilities is approximately 28,100 acre-feet (Banner Supplemental Information, 1979). A comprehensive outline of available supplies from Douglas Creek is presented in the 1976 Banner Report on Proposed Expansion of Cheyenne's Douglas Creek Facilities.

The potential yield of the existing Stage I facilities in the Douglas Creek drainage is approximately 13,000 acre-feet per year. Currently, 7,400 acre-feet are being used. It is proposed that diversion and storage facilities in the Douglas Creek drainage would be enlarged and expanded to increase the average annual Douglas Creek yield to 26,900 acre-feet. 2/ The west slope collection facilities, sized to produce an average annual yield of 26,900 acre-feet, would convey west slope water through the transcontinental divide tunnel and into Hog Park Reservoir.

A detailed analysis of the water supplies available from an expansion of the Little Snake diversion system is presented in the Report on Proposed Expansion of Cheyenne's Little Snake Diversion Facilities (Banner and Associates, 1976).

Stage II Little Snake Diversion Pipeline - Diversion structures would be constructed on Rose Creek, Third Creek, Harrison Creek, Deadman Creek, Solomon Creek, West Branch North Fork of Little Snake, Rabbit Creek, Roaring Fork of Little Snake, Sherard Creek and several small tributary streams in the Little Snake drainage. These

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1/ A description of the CBPU Proposed Action is found in Part B of Chapter II.

2/ Stage I Yield = 7,400 A.F.
New Stage II Yield = 19,500 A.F. (Appendix II, Itemized Costs, pg. II-123, Revised Draft Appendix).

facilities would divert runoff giving the west slope a potential water yield of 26,900 acre-feet, including flows from a modified Stage I system. This yield could be potentially available while providing the maintenance and flushing flows required (Appendix II, p. II-21).

A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and would be constructed westerly and southerly. This pipe would be approximately 151,100 feet in length and would range from 72 inches to 12 inches in diameter (Itemized Costs, Appendix II, pg. II-123, Revised Draft Appendix). In addition, 20.4 miles of access road would be required for construction and maintenance. The roads would be located so that the road and pipeline would occupy the same route.

<u>Stage II Hog Park Drop</u> - A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir, paralleling the existing pipeline. This pipeline would total approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.

<u>Stage II Hog Park Reservoir Enlargement</u> - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, and increase the reservoir from 175 to 695 surface acres. The reservoir would impound the water from the west slope and provide an average annual replacement water release of 26,900 acre-feet. Replacement of 3.0 miles of road would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground and a new access road would be required.

<u>Stage II Rob Roy Reservoir Enlargement</u> - The existing Rob Roy Reservoir on Douglas Creek would be enlarged from 8,895 acre-feet to a capacity of approximately 35,400 acre-feet. This enlargement would raise the existing earthfill dam 50 feet, result in a high water elevation of 9,470 feet and increase the lake size from 314 to 800 acres. The reservoir would impound runoff from 20.8 square miles of the upper Douglas Creek watershed and could maintain an average annual yield of 20,250 acre-feet (Banner Supplemental Information, 1979). This yield would be available and provide the required maintenance flow below the Douglas Creek diversion structure (Appendix II, p. II-21). The proposed high water line of 9,470 feet would inundate an additional 487 acres of land. A road 3.9 miles long would be constructed along the shoreline to provide access around the reservoir. The existing boat ramp and campground would be relocated above the new high water line.

Stage II Douglas Creek Area System - Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the Stage I pipeline along the existing right-of-way, and ending at Lake Owen Reservoir. The pipeline would be approximately 57,000 feet in length and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information, 1979).

The existing Horse Creek diversion would produce an average annual yield of about 1,500 acre-feet. Additional instream diversion structures would be constructed on North Branch of Muddy Creek, East Branch of Camp Creek, Middle Branch of Camp Creek, Camp Creek, Beaver Creek, Nugget Gulch Branch of Beaver Creek, Gold Crater Creek, and Podunk Creek, all tributaries of Douglas Creek. The new collectors would gather runoff from 1,380 acres of watershed above the Douglas Creek to Lake Owen Pipeline and would yield an average of about 1,900 acre-feet per year. Maintenance and flushing flows would be required as listed in Appendix II, p. II-21. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff via gravity to the existing Douglas Creek to Lake Owen Pipeline (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce the total disturbed area.

Stage II Lake Creek System - Diversion structures and pipelines would be constructed to divert water from Lake Creek, Hay Creek, East Branch of Hay Creek, West Branch of Hay Creek, Joe Creek, H.T. Creek, Banner Creek, and Collins Creek, all tributaries of Douglas Creek. These structures would divert runoff from 3,170 acres of the Lake Creek watershed for an average annual yield of 2,450 acre-feet; however, maintenance and flushing flows would reduce this to approximately 2,000 acre-feet. Maintenance and flushing flows would be required as listed in Appendix II. The collected water would be delivered to Lake Owen by gravity flow through approximately 73,500 feet of pipeline having a capacity of 30 cubic feet per second. An access road 11.9 miles long would be required for construction and maintenance (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce the total disturbed area.

Total Yield - Douglas Creek Drainage - The total yield from the Douglas Creek drainage would be 26,900 acre-feet per year.

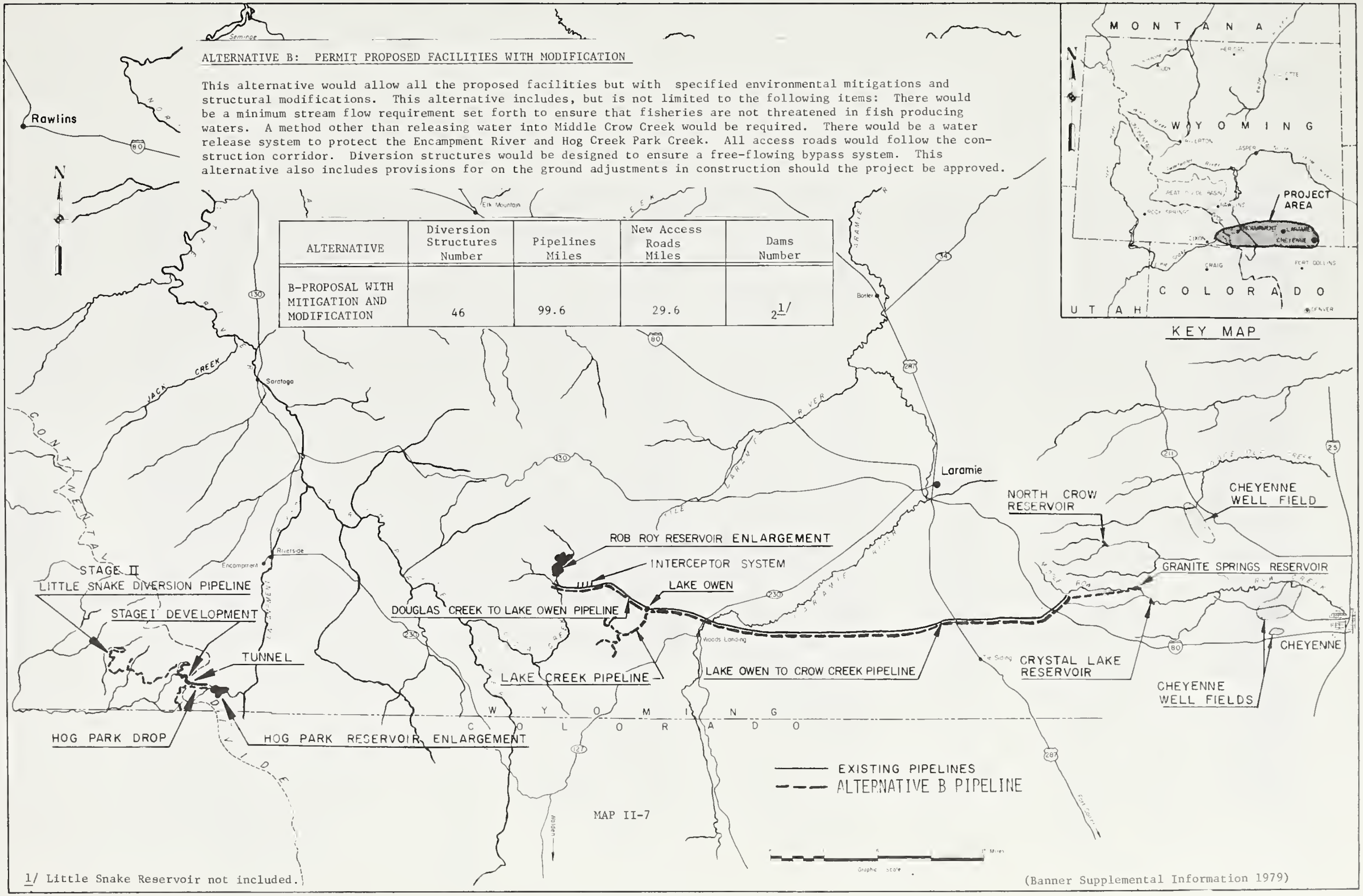
Stage II Lake Owen - Pole Mountain System - An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would be built, beginning at Lake

Owen, across the Laramie River Valley parallel to the existing pipeline on the right-of-way, and terminate at the east boundary of the Medicine Bow National Forest on Pole Mountain to meet Forest Service constraints. From this point, Middle Crow Creek could be augmented on private land or the pipeline could continue to Crystal Reservoir. The pipeline was proposed to be 207,600 feet in length with a gravity flow capacity of 26 cubic feet per second (Banner Supplemental Information 1979); however, an additional 21,100 feet of pipe would be necessary to transport water to the forest boundary.

ALTERNATIVE B: PERMIT PROPOSED FACILITIES WITH MODIFICATION

This alternative would allow all the proposed facilities but with specified environmental mitigations and structural modifications. This alternative includes, but is not limited to the following items: There would be a minimum stream flow requirement set forth to ensure that fisheries are not threatened in fish producing waters. A method other than releasing water into Middle Crow Creek would be required. There would be a water release system to protect the Encampment River and Hog Creek Park Creek. All access roads would follow the construction corridor. Diversion structures would be designed to ensure a free-flowing bypass system. This alternative also includes provisions for on the ground adjustments in construction should the project be approved.

ALTERNATIVE	Diversion Structures Number	Pipelines Miles	New Access Roads Miles	Dams Number
B-PROPOSAL WITH MITIGATION AND MODIFICATION	46	99.6	29.6	2 1/



MAP II-7

1/ Little Snake Reservoir not included.

(Banner Supplemental Information 1979)

c. <u>Alternative C: (Preferred Alternative) - MODIFY STAGE I COLLECTION SYSTEM TO INCREASE CAPACITY AND EXTEND THE PROPOSED SYSTEM TO THE VICINITY OF WEST BRANCH OF THE NORTH FORK LITTLE SNAKE RIVER</u> (See Map II-8, p.93)

Under this alternative, the Stage II collection facilities in the Little Snake drainage would be extended only to the West Branch and some of its tributaries. The Roaring Fork and its tributaries would not be diverted. The Stage I diversion system in the Little Snake drainage would be modified to transfer Ted Creek water into the Stage II pipeline.

This would increase the diversion efficiency of the remaining Stage I system. Approximately one-half mile of additional pipeline would be required from Third Creek to Ted Creek.

Alternative C would involve the development of Douglas Creek water for transmission of 23,200 acre-feet to the Pole Mountain area. 1/ The west slope facilities in the Little Snake River drainage would be designed to collect an approximate total of 23,200 acre-feet a year. This water would pass through the transcontinental divide tunnel and into Hog Park Reservoir.

<u>Stage II Little Snake Diversion Pipeline</u> - Diversion structures would be constructed on Rose Creek, Third Creek, Harrison Creek, Deadman Creek Solomon Creek, West Branch of North Fork of Little Snake, Rabbit Creek, and several smaller tributary streams in the Little Snake drainage. These facilities would divert runoff from 10,800 acres of watershed for an additional west slope water yield of about 15,800 acre-feet (Appendix II, Itemized Costs, pg. II-132, Revised Draft Appendix). This yield could be available while providing the maintenance and flushing flows required (Appendix II, p. II-21). A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 116,700 feet in length and have a gravity flow capacity of 268 cubic feet per second from the west segment and 64 cubic feet per second from the south segment. Pipeline sizes would be 72 inches to 12 inches in diameter (Appendix II, Itemized Costs, pg. II-132, Revised Draft Appendix). In addition, 16.0 miles of access road would be required for construction and maintenance. The roads would be located so that the road and pipeline would occupy the same right-of-way.

1/ Stage I Yield = 7,400 A.F.
New Stage II Yield = 15,800 A.F. (Appendix II, Itemized Costs, p. II-132, Revised Draft Appendix).

Stage II Hog Park Drop - A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir along the existing Hog Park Drop Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.

Stage II Hog Park Reservoir Enlargement - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water elevation in the reservoir of 8,450 feet. This would increase the lake size from 175 to 695 acres. The reservoir would impound the water from the west slope and provide an average annual replacement water release of 26,900 acre-feet. A replacement road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground as well as a new access road would be required.

Stage II Rob Roy Reservoir Enlargement - The existing Rob Roy Reservoir on Douglas Creek would be enlarged from 8,895 acre-feet to a capacity of approximately 35,400 acre-feet. This enlargement would require raising the existing earthfill dam 50 feet, resulting in a high water elevation of 9,470 feet. This would increase the reservoir size from 314 to 800 acres. The reservoir would impound runoff from 20.8 square miles of the upper Douglas Creek watershed and would maintain an average annual yield of 20,250 acre-feet (Banner Supplemental Information, 1979). This yield would be available and would provide the required maintenance flow below the Douglas Creek diversion structure (Appendix II, p. II-21). The proposed high water line 9,470 feet elevation would cover an additional 487 acres of land. A road 3.9 miles long would be constructed along the shoreline to provide access around the reservoir. The existing boat ramp and campground would be relocated above the new high water line.

Stage II Douglas Creek Area System - Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the Stage I pipeline, using the existing right-of-way, and ending at Lake Owen Reservoir. The pipeline would be approximately 57,000 feet in length and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information, 1979).

The existing Horse Creek diversion would produce an average annual yield of about 1,500 acre-feet. Several addi-

tional small instream diversion structures would be constructed on North Branch of Muddy Creek, East Branch of Camp Creek, Middle Branch of Camp Creek, Camp Creek, Beaver Creek, Nugget Gulch Branch of Beaver Creek, Gold Crater Creek, and Podunk Creek, all tributaries of Douglas Creek. The new collectors would gather runoff from 1,380 acres of watershed, above the Douglas Creek to Lake Owen Pipeline. They would yield an average of about 1,900 acre-feet per year. Maintenance and flushing flows would be required as listed Appendix II, p. II-21. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff by gravity to the existing Douglas Creek-Lake Owen Pipeline and into Lake Owen (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce the total disturbed area.

Stage II Lake Creek System - Diversion structures and pipelines would be constructed to divert water from Lake Creek, Hay Creek, East Branch of Hay Creek, West Branch of Hay Creek, Joe Creek, H.T. Creek, Banner Creek, and Collins Creek, all tributaries of Douglas Creek. These structures would divert runoff from 3,170 acres of the Lake Creek watershed for an average annual yield of 2,450 acre-feet; however, maintenance and flushing flows would reduce this to 2,000 acre-feet. Maintenance and flushing flows would be required as listed in Appendix II, p. II-21. The collected water would be delivered to Lake Owen by gravity flow through approximately 73,500 feet of pipeline having a capacity of 30 cubic feet per second. An access road 11.9 miles long would be required for construction and maintenance (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce total disturbed areas.

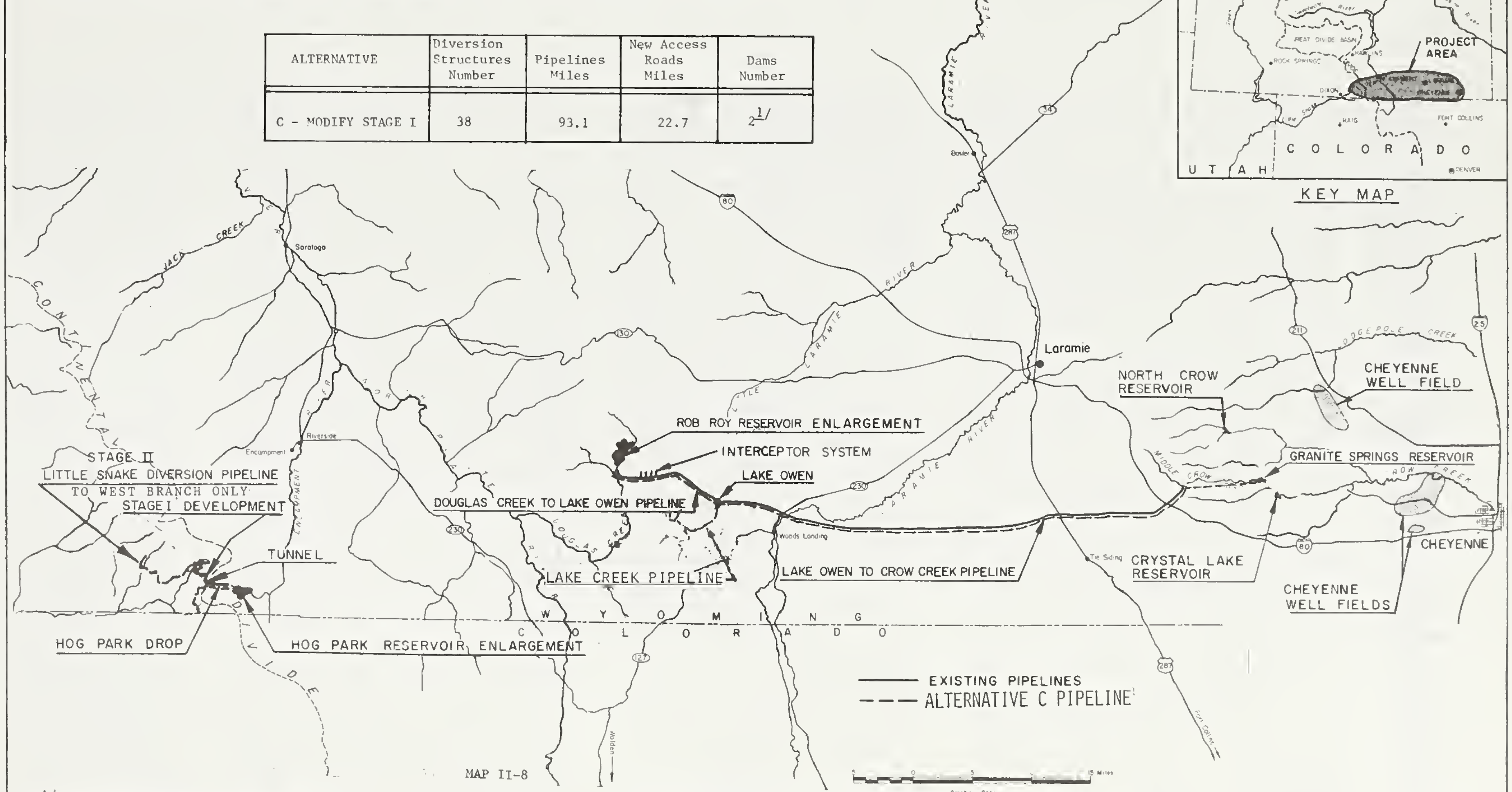
Total Yield-Douglas Creek Drainage - The total yield from the Douglas Creek drainage would be 23,200 acre-feet per year.

Lake Owen - Pole Mountain System - An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would be built, beginning at Lake Owen, across the Laramie River Valley, parallel to the existing pipeline on the existing right-of-way, and terminate at the east boundary of the Medicine Bow National Forest on Pole Mountain to meet Forest Service constraints. From this point, Middle Crow Creek could be augmented on private land or the pipeline could continue to Crystal Reservoir. The pipeline was proposed to be 207,600 feet in length with a gravity flow capacity of 26 cubic feet per second (Banner Supplemental Information, 1979); however, an additional 21,100 feet of pipe would be necessary to transport water to the forest boundary.

ALTERNATIVE C: MODIFY STAGE I COLLECTION SYSTEM TO INCREASE CAPACITY AND EXTEND THE PROPOSED SYSTEM TO THE VICINITY OF WEST BRANCH NORTH FORK - LITTLE SNAKE RIVER.

This alternative is a result of several concerns, primarily those dealing with the possibility of extensive environmental damage. Although the existing system collects 7,400 acre-feet, this may not be all of the allowable water available during the heavy runoff period. Modification would include redesign of the diversion structures to improve bypass and collection. There would be additional pipe in the same right-of-way as Stage I. The pipe would be needed to carry the extra volume and would be in a previously distrubed area. Additional collection area would extend to the vicinity of the West Branch of the North Fork of the Little Snake River.

ALTERNATIVE	Diversion Structures Number	Pipelines Miles	New Access Roads Miles	Dams Number
C - MODIFY STAGE I	38	93.1	22.7	2 1/



MAP II-8

(Banner Supplemental Information 1979)

1/ Little Snake Reservoir not included.

d. Alternative D: CONSTRUCT A RESERVOIR LOWER IN THE NORTH FORK OF THE LITTLE SNAKE RIVER AND PUMP WATER INTO THE EXISTING SYSTEM (See Map II-9, p. 97).

This alternative would change the concept of the original proposal. A reservoir would be constructed on the North Fork of the Little Snake River at the confluence of the West Branch. It would impound stream water during the high runoff period. This reservoir would provide an average annual yield for Cheyenne, of 18,000 acre-feet. This combined with Cheyenne's current water supply system would produce a total of 32,700 acre-feet per year from the Douglas Creek section. A pumping station at the Little Snake Reservoir would deliver water through a transmission pipeline to the west portal of the transcontinental divide tunnel. From the west portal, water would flow by gravity through the tunnel and into Hog Park Reservoir. There would be no need to construct the Little Snake diversion pipeline system.

Little Snake Reservoir - A dam would be constructed on the North Fork of the Little Snake River approximately one-half mile north of the Colorado state line. The maximum water surface of the reservoir would be at an elevation of approximately 7,545 feet. The storage volume would be about 33,000 acre-feet. The reservoir would impound runoff from a 45 square mile watershed area on the North Fork of the Little Snake River. A 325 foot earthfill or rockfill dam would be required to obtain a high water level of 7,545 feet at this site. The proposed high water level would cover about 400 acres of land (Banner Supplemental Information, 1979).

Little Snake River Pipeline and Pump Station - A high pressure pipeline beginning at the pumping station would be required to convey Little Snake replacement water to the west portal of the existing transcontinental divide tunnel. The pipeline would be approximately 38,200 feet in length and have a capacity of 65 cubic feet per second. This pumping system would operate approximately six months a year, because maintenance access would be possible only during the snow free season. A new access road 8.8 miles long would be constructed to the reservoir, pump station, and pipeline for construction and maintenance. The roads would be located so that the road and pipeline would occupy the same route. Additional rights-of-way would be needed for power facilities.

A 42 million gallon per day pumping station at the Little Snake Reservoir would be required to lift the water from the reservoir to the tunnel. It would be located upstream of the dam. This station would pump water from the reservoir and discharge it into the west portal of the transcontinental divide tunnel. The pumping station

would be sized to deliver 20,100 acre-feet of water. The pumping head would average about 1,650 feet (Banner Supplemental Information, 1979).

Stage II Hog Park Drop - A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park Drop Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.

Stage II Hog Park Reservoir Enlargement - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 22,540 acre-feet. This enlargement would raise the existing earthfill dam 50 feet, resulting in a high water level in the reservoir of 8,450 feet elevation. This would increase the reservoir from 175 to 448 acres. The reservoir would impound the water from the west slope and provide an annual replacement water release. A relocated road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground, as well as a new access road would be required.

Stage II Rob Roy Reservoir Enlargement - The existing Rob Roy Reservoir on Douglas Creek would be enlarged from 8,895 acre-feet to a capacity of approximately 35,400 acre-feet. This enlargement would require raising the existing earthfill dam 50 feet, resulting in a high water elevation of 9,470 feet. This would increase the reservoir size from 314 acres to 800 acres. The reservoir would impound runoff from 20.8 square miles of the upper Douglas Creek watershed and could maintain an average annual yield of 20,250 acre-feet. This yield would be available and would provide the required maintenance flow below the Douglas Creek diversion structure (Appendix II, p. II-21). The proposed high water line of 9,470 feet would inundate an additional 487 acres of land. A road 3.9 miles long would be constructed along the shoreline to provide access around the reservoir. The existing boat ramp and campground would be relocated above the new high water line.

Stage II Douglas Creek Area System - Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the Stage I pipeline along the existing right-of-way, and ending at Lake Owen Reservoir. The pipeline would be approximately 57,000 feet in length and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information, 1979).

The existing Horse Creek diversion would produce an average annual yield of about 1,500 acre-feet. Several additional small instream diversion structures would be constructed on North Branch of Muddy Creek, East Branch of Camp Creek, Middle Branch of Camp Creek, Camp Creek, Beaver Creek, Nugget Gulch Creek, Gold Crater Creek, and Podunk Creek, all tributaries of Douglas Creek. The new collectors would gather runoff from 1,380 acres of watershed above the Douglas Creek to Lake Owen Pipeline. They would yield an average of about 1,900 acre-feet per year. Maintenance and flushing flows would be required as listed in Appendix II, p. II-21. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff by gravity to the existing Douglas Creek to Lake Owen Pipeline (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce the total disturbed area.

Stage II Lake Creek System - Diversion structures and pipelines would be constructed to divert water from Lake Creek, Hay Creek, East Branch Hay Creek, West Branch Hay Creek, Joe Creek, J.T. Creek, Banner Creek, and Collins Creek, all tributaries of Douglas Creek. These structures would divert runoff from 3,170 acres of the Lake Creek watershed for an average annual yield of 2,450 acre-feet; however, maintenance and flushing flows would reduce this to approximately 2,000 acre-feet. Maintenance and flushing flows would be required as listed in Appendix II, p. II-21. The collected water would be delivered from the collectors to Lake Owen by gravity flow through approximately 73,500 feet of pipeline having a capacity of 30 cubic feet per second. An access road 11.9 miles long would be required for construction and maintenance (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce the total disturbed area.

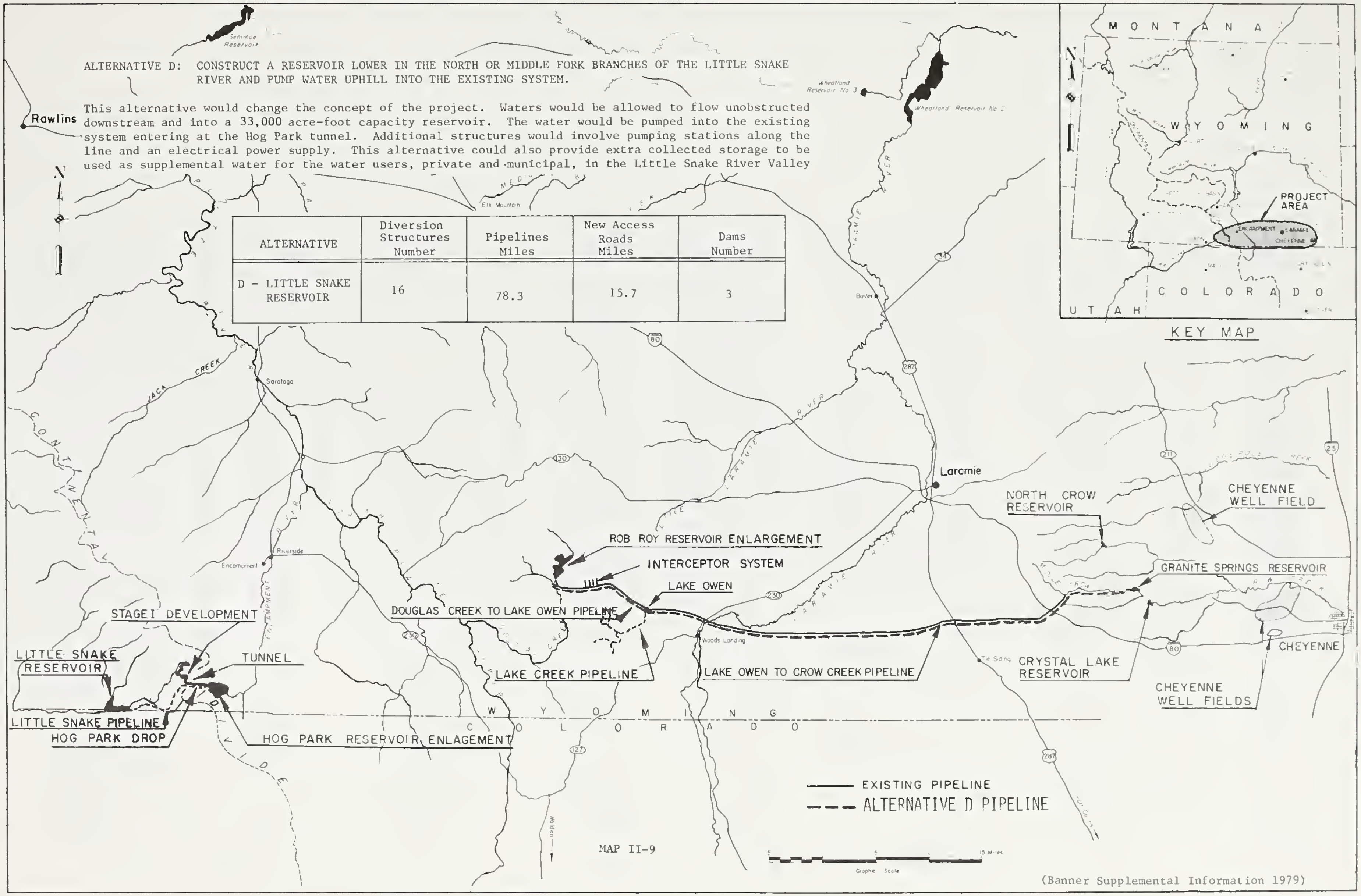
Total Yield-Douglas Creek System - The total yield from the Douglas Creek drainage would be 26,900 acre-feet per year.

Lake Owen to Pole Mountain System - An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would be built, beginning at Lake Owen, across the Laramie River Valley, parallel to the existing pipeline on the existing right-of-way, and terminate at the east boundary of the Medicine Bow National Forest on Pole Mountain to meet Forest Service constraints. From this point, Middle Crow Creek could be augmented on private land or the pipeline could continue to Crystal Reservoir. The pipeline was proposed to be 207,600 feet in length with a gravity flow capacity of 26 cubic feet per second (Banner Supplemental Information, 1979); however, an additional 21,100 feet of pipe would be necessary to transport water the Forest Boundary.

ALTERNATIVE D: CONSTRUCT A RESERVOIR LOWER IN THE NORTH OR MIDDLE FORK BRANCHES OF THE LITTLE SNAKE RIVER AND PUMP WATER UPHILL INTO THE EXISTING SYSTEM.

This alternative would change the concept of the project. Waters would be allowed to flow unobstructed downstream and into a 33,000 acre-foot capacity reservoir. The water would be pumped into the existing system entering at the Hog Park tunnel. Additional structures would involve pumping stations along the line and an electrical power supply. This alternative could also provide extra collected storage to be used as supplemental water for the water users, private and municipal, in the Little Snake River Valley

ALTERNATIVE	Diversion Structures Number	Pipelines Miles	New Access Roads Miles	Dams Number
D - LITTLE SNAKE RESERVOIR	16	78.3	15.7	3



MAP II-9

(Banner Supplemental Information 1979)

e. Alternative E: COMBINE WATER CONSERVATION, WATER RIGHTS PURCHASE AND GROUND WATER DEVELOPMENT (See Map II-10, p. 101)

This alternative would provide for a substantial reduction in construction on Federal surface while supplying approximately 13,000 acre-feet of water annually. Water conservation would be instituted over a 30 year period reducing consumption by 10% each decade up to 2010. The average savings would be about 5,100 acre-feet a year after the year 1995 (Calculations - Chapter II, p. 38).

Agricultural water rights would be purchased from willing sellers. This would gain 8,000 acre-feet which would allow for the use of the 4,100 acre-feet currently stored in Rob Roy Reservoir plus 3,900 acre-feet which could be developed from the Lake Creek and Douglas Creek drainages. The water purchased would be released directly into the North Platte system as payback water, eliminating the Little Snake collection system.

There would be 5,000 acre-feet of groundwater developed. This is the least amount of water economically feasible to develop and still contribute the least cost to the combined system. A pump and pipeline system would be developed off the National Forest.

Development of facilities would include: enlarging of the Douglas Creek-Lake Owen pipeline; developing the Lake Creek Reservoir; enlarging the Lake Owen-Pole Mountain pipeline and install the Pole Mountain pipeline.

Stage II Little Snake Diversion Pipeline -

The Stage I system would not be modified or altered except for changes that could be made within the conditions of the existing permit. There would be no further development of collection facilities in the Little Snake River System.

Stage II Hog Park Drop -

There would be no further expansion of this facility. The existing pipeline would remain.

Stage II Hog Park Reservoir Enlargement -

The existing Hog Park Reservoir would remain at a capacity of 2,970 acre-feet. There would be no enlargement of the reservoir and it would remain at 175 surface acres. There would be no alterations in the current operation other than those allowed within the existing permit.

Stage II Rob Roy Reservoir -

The existing Rob Roy Reservoir on Douglas Creek would store 8,895 acre-feet covering 314 acres. There would be no further increase in size or alteration in current operations other than those allowed within the existing permit.

Stage II Douglas Creek Area System -

Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the Stage I pipeline along the existing right-of-way, and ending at Lake Owen Reservoir. The pipeline would be approximately 57,000 feet in length and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information, 1979).

The existing Horse Creek Diversion would produce an average annual yield of about 1,500 acre-feet. Additional instream diversion structures would be constructed on North Branch of Muddy Creek, East Branch of Camp Creek, Middle Branch of Camp Creek, Camp Creek, Beaver Creek, Nugget Gulch Branch of Beaver Creek, Gold Crater Creek, the Podunk Creek, all tributaries of Douglas Creek. The new collectors would gather runoff from 1,380 acres of watershed above the Douglas Creek to Lake Owen Pipeline and would yield an average of about 1,900 acre-feet per year. Maintenance and flushing flows would be required as listed in Appendix II, p. II-22. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff via gravity to the existing Douglas Creek to Lake Owen Pipeline (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce the total disturbed area.

Stage II Lake Creek System -

Diversion structures and pipelines would be constructed to divert water from Lake Creek, Hay Creek, East Branch of Hay Creek, West Branch of Hay Creek, Joe Creek, H.T. Creek, Banner Creek and Collins Creek, all tributaries of Douglas Creek. These structures would divert runoff from 3,170 acres of the Lake Creek watershed for an average annual yield of 2,450 acre-feet; however, maintenance and flushing fows would reduce this to approximately 2,000 acre-feet. Maintenance and flushing flows would be required as listed in Appendix II, p. II-22. The collected water would be delivered to Lake Owen by gravity flow through approximately 73,500 feet of pipeline having a capacity of 30 cubic feet per second. An access road 11.9 miles long would occupy the same right-of-way to reduce the total disturbed area (Banner Supplemental Information, 1979). The road and pipeline would occupy the same right-of-way to reduce the total disturbed area.

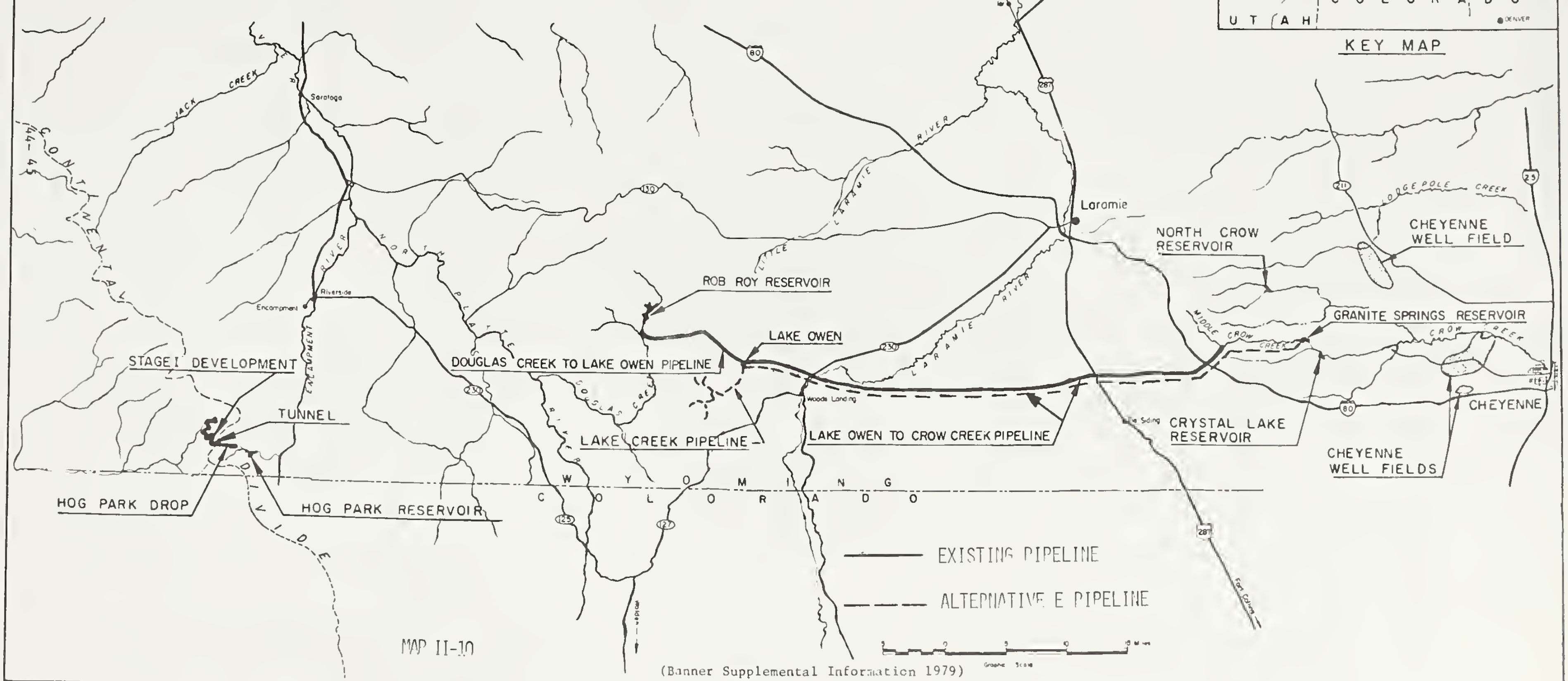
Stage II Lake Owen - Pole Mountain System -

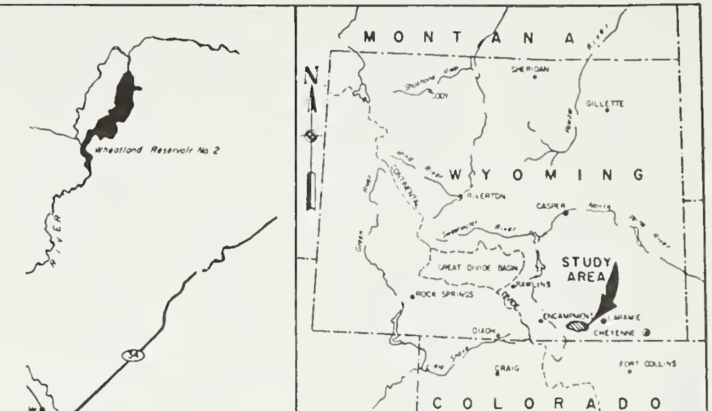
An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would be built, beginning at Lake Owen, across the Laramie River Valley parallel to the existing pipeline on the right-of-way, and terminate at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline was proposed to be 207,600 feet in length with a gravity flow capacity of 26 cubic feet per second (Banner Supplemental Information 1979); however, an additional 21,100 feet of pipe would be necessary to transport water to the forest boundary.

ALTERNATIVE E: COMBINE WATER CONSERVATION, AGRICULTURAL WATER RIGHT PURCHASE AND GROUND WATER DEVELOPMENT.

This alternative would maximize water conservation, develop ground water and use agricultural water rights to yield approximately 18,100 acre-feet per year. Construction and surface disturbance on federal land would be less than any other action alternative.

ALTERNATIVE	Diversion Structures Numbers	Pipelines Miles	New Access Roads Miles	Dams Numbers
E - COMBINED	16	70.8	11.9	0





MAP II-10

(Banner Supplemental Information 1979)

ENVIRONMENTAL IMPACTS

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
1. Economics					
a. Amount of Water Produced for Cheyenne Total/Additional -Acre-feet	14,700 / 0	34,200 / 19,500	30,500 / 15,800	32,700 / 18,000	27,700 / 13,000
b. Cost to Consumer - Rate/1000 gal.-1980 Dollars (Low Use) 1/ - Rate/Acre-foot	$.87 / $294	$2.33 / $790	$2.53 / $858	$4.38 / $1429	$2.33 / $788
c. Cost to Consumer - Rate/1000 gal.-1980 Dollars (High Use) 2/ -Rate/Acre-foot	$.60 / $203	$1.61 / $545	$1.74 / $592	$3.01 / $981	$1.61 / $543
d. Cost to Cheyenne -Rate/1000 gal.-1980 Dollars -Rate/Acre-foot	$.29 / $97	$1.16 / $393	$1.26 / $427	$2.18 / $711	$1.16 / $392
e. Project Construction Costs -1980 Dollars	0	$100,355,000	$83,346,000	$138,543,000	$53,453,000
f. Annual Maintenance Costs Do Not Include Annual Special Use Fees -1980 Dollars	$50,000	$126,500	$114,500	$2,405,000	$1,102,200
g. Forest Service Administrative Costs Construction Monitoring -1980 Dollars	0 / $620	$62,000 / $990	$57,000 / $990	$37,200 / $774	$15,000 / $700
h. Electrical Power Consumed - Killowatt Hours	14,700	14,700	14,700	33,320,000	5,514,400
i. Term of Supply at Current Consumption Rates					
High Growth Rate -Without Cons. -With Cons.	1980 / 1981	2010 / 2039	2004 / 2027	2008 / 2027	2000 / 2018
Average Growth Rate -Without Cons. -With Cons.	1980 / 1983	2032 / 2070+	2022 / 2070+	2028 / 2070+	2015 / 2070+
Low Growth Rate -Without Cons. -With Cons.	1982 / 2040	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+
2. Resource Management					
a. Watershed					
1) Riparian Habitat -Acres Lost/Net after Mitigation	(-) 0 / (+) 0	(-) 454 / (-) 354	(-) 454 / (-) 354	(-) 459 / (-) 359	(-) 0 / (+) 0
2) Salinity Increase Range - mg /liter (Colorado River at Imperial Dam)	0	1.89 - 2.17	1.53 - 1.76	1.89 - 2.17	0
b. Fisheries					
1) Game Species Existing	4	4	4	4	4
2) Trout Streams Diverted	0	13	11	4	4
3) Miles of Stream - Lost - Net miles after Mitigation	(-) 0 / (+) 0	(-) 9.7 / (-) 5.1	(-) 9.7 / (-) 5.1	(-) 14.6 / (-) 10.0	(-) 0 / (+) 0
4) Total Stage II Trout Habitat Units -Lost -Net Habitat Units after Mitigation	(-) 0 / (+) 0	(-) 484 / (+) 15	(-) 457 / (+) 40	(-) 1138 / (-) 627	(-) 18 / (+) 221
5) Colorado River Cutthroat Trout 3/ -Habitat Units Lost -Net Habitat Units after Mitigation	(-) 270 / (-) 270	(-) 291 / (-) 39	(-) 291 / (-) 39	(-) 270 / (-) 18	(-) 270 / (-) 270
6) Stage I Trout Habitat Units -Lost Due to Inadequate Streamflows -Regained by Providing Streamflows	(-) 811 / (+) 0	(-) 811 / (+) 811	(-) 811 / (+) 811	(-) 811 / (+) 811	(-) 811 / (+) 0
c. Recreation					
1) Potential Dispersed Recreation Change Semi-Primitive to Rural - Acres	0	8,400	6,300	2,700	0
2) Developed Recreation Sites Displaced and Relocated - PAOT	0	375	375	375	0
d. Wilderness Potential					
1) Acres Available	67,322	62,112	65,892	67,322	67,322
2) Character Rating	0	(-) 24	(-) 9	(-) 1	0

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
e. Soils 1) Surface Disturbance -Acres	0	2,675	2,552	3,079	340
2) Mass Land Failure Potential (Can be Mitigated by Design) -Acres	0	714	150	740	0
3) Areas of Very Low Revegetation Potential -Acres	0	587	320	500	0
f. Range - Grazing Capacity - AUM's Lost	0	447	408	455	0
g. Terrestrial Wildlife 1) Game Species Present Number of Species	17	17	17	17	17
2) Nongame Species Present Number of Species	230	230	230	230	230
3) Habitat -Acres Lost -Net Acres after Mitigation	(-) 0 / (+) 0	(-) 1078 / (-) 78	(-) 992 / (+) 8	(-) 1449 / (-) 449	(-) 0 / (+) 0
4) Consumptive Use - User Days	1,100	2,500	2,500	1,100	1,100
5) Nonconsumptive Use - User Days	100	300	300	100	100
h. Threatened or Endangered Fish Species - Present Downstream	3	3	3	3	3
i. Visual Resources - Acres of Outstanding Quality Altered	0	493	493	293	0
j. Tree Resource - Acres Lost	0	532	450	764	110
k. Transportation - New Road Construction - Miles	0	29.6	22.7	15.7	11.9
l. Cultural Resources - Acres Needing Survey	0	2,675	2,552	3,079	340
State-County Plans a. State Plans 1) Meets Goals Land Plan	100%	100%	100%	100%	100%
2) Meets Goals Water Plan 4/	0%	97%	80%	90%	0%
b. County Plans 1) Meets Goals Land Plan	100%	100%	100%	100%	100%
2) Meets Goals Water Plan	0%	100%	87%	100%	0%
3) Domestic Water Use	0%	100%	87%	100%	30%

1/ Low Use = Primarily residential use of less than 250,000 gallons per month.

2/ High Use = Primarily commercial use of more than 250,000 gallons per month. .60/100 gal. is charged after 250,000 is reached

3/ Habitat units for Colorado River Cutthroat Trout are cumulative for Stage I and Stage II because of the "Sensitive" status of this subspecies in Wyoming and because the North Fork drainage is essential to its continued existence.

4/ Full development of unobligated surface water supplies would equal 100%.

○ DOES NOT RESOLVE ISSUE

◒ POTENTIAL TO RESOLVE ISSUE AT LEAST PARTIALLY (50%)

● POTENTIAL TO RESOLVE ISSUE TOTALLY

4. <u>Potential to Resolve Public Issues</u> 1/

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
a. Alternative Water Sources to Stage II	●	○	○	○	●
b. Increased Stream Flows	●	◒	◒	◒	●
c. Decreased Stream Flows	○	●	●	●	○
d. Reservoir Fluctuation	●	◒	◒	◒	◒
e. Colorado River Salinity	●	◒	◒	◒	●
f. New Access into Unroaded Areas	●	◒	◒	●	●
g. Fish Habitat	●	◒	◒	●	●
h. Downstream Water Users	●	◒	◒	●	●
i. Threatened or Endangered Species	●	●	●	●	●
j. Terrestrial Wildlife Impacts	●	○	○	○	●
k. Water Supplies to Other Communities	○	●	◒	●	○
l. Reservoir Safety	●	●	●	●	●
m. Development of Compact Allocated Water	○	◒	◒	●	○
n. Role of Water Conservation Maximized	●	◒	◒	◒	●

1/ Resolution Potential includes mitigation specified for each action alternative.

III. AFFECTED ENVIRONMENT

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III. AFFECTED ENVIRONMENT

A. OVERVIEW

The Affected Environment describes the area to be affected by the proposed action and alternatives (40 CFR 1502.15).

Section B, Description of Affected Area, is a general geographic discussion of the Medicine Bow, other areas and existing situations which are or could be affected were the CBPU proposal to become a reality. Section B includes a brief discussion of the existing CBPU water system currently occupying a portion of the geographic area. Section C is a description of the various resource elements that would be affected. These resource elements are those identified through the public and inservice scoping sessions which produced the public issues and management concerns described in Chapters I and II. All of these resource elements have had mitigating measures assigned to lessen the adverse impacts. Impacts on the affected environment which cannot be fully mitigated are discussed further in the "Summary of Adverse Impacts that Cannot be Mitigated," Section E of Chapter IV.

B. DESCRIPTION OF AFFECTED AREA

The study area encompasses a large portion of southcentral and southeastern Wyoming. Carbon, Albany, and Laramie Counties are located within the study area. The proposal would be built within the Medicine Bow National Forest and along an existing right-of-way between Rob Roy Reservoir and the city of Cheyenne, Wyoming. The terrain varies from flat to rolling rangeland to forested mountain ranges. The mountain areas are remote and are generally inaccessible six months of the year.

The three areas of the Medicine Bow National Forest that would be affected by this proposal are: the Sierra Madre Mountains southwest of Encampment, Wyoming; the Medicine Bow Mountains west of Laramie, Wyoming; and Pole Mountain, within the Sherman Mountains, east of Laramie. There would be construction on all three areas. New construction in previously unaffected areas would be found primarily in the Sierra Madre area, consequently the majority of newly affected environments also occur in this area. There are portions of four sections of land managed by the Bureau of Land Management which would be crossed by 2.15 miles of pipeline between Lake Owen and Middle Crow Creek.

There are irrigation water rights in the Little Snake Valley. Some of these rights are on streams below the proposed diversions. There are also irrigation demands on larger streams in Colorado, Arizona and California which have water contributed by the Little Snake River.

The Stage I system was installed in the early 1960's and has the capacity to collect approximately 7,400 acre-feet of water annually. The Cheyenne Board of Public Utilities determined this amount will no longer meet the needs of Cheyenne and submitted a request asking to expand their system to collect an additional 23,000 acre-feet. This original proposal has been modified. The main portions of planned Stage II development were shown on Maps III-A and III-B, located in the map pocket of the Revised Draft Environmental Impact Statement.

There are diversion and collection facilities, including one 175 acre reservoir in the Sierra Madre Mountains southwest of Encampment, Wyoming. This portion of the system collects water from tributaries of the Little Snake River in the Colorado River basin and transports the water under the Continental Divide into Hog Park Reservoir. The water flows to the North Platte River via Hog Park Creek and the Encampment River. This is used in replacement of water taken from Douglas Creek and transported to Cheyenne because Cheyenne does not have permits for North Platte water.

The existing transmission and storage facilities in the Medicine Bow Mountains consist of a 314 acre storage reservoir (Rob Roy Reservoir), a diversion structure on Douglas Creek, a small lake (Lake Owen) which acts as a pressure relief, and a pipeline to transport the water to Middle Crow Creek on Pole Mountain.

The third portion of the existing system consists of a culvert drop into a tributary of Middle Crow Creek near Vedauwoo Campground on Pole Mountain. The water flows down Middle Crow Creek to Crystal and Granite Reservoirs where it is stored for use by Cheyenne.

C. RESOURCE ELEMENTS

1. Socioeconomic

a. Population. In addition to the large communities of Cheyenne and Laramie, there are several small communities in the study area varying in population from 82 to 11,450. These communities and their populations are listed in Table III-1. Additionally, there are small, unincorporated communities within the study area which consist of recreational cabin areas.

The population fluctuated in the study area from 1940 through 1970. A sharp increase was experienced between 1970 and 1980 and it can be attributed to the development of resources and energy. This development has attracted many people to the area. Table III-1 provides population data for the communities in the study area.

TABLE III-1
WYOMING COMMUNITIES IN THE STUDY AREA

Community	1940	1950	1960	1970	1980
Baggs	221	206	199	146	430
Dixon	94	124	108	72	82
Encampment/ Riverside	399	338	420	367	666
Rawlins	5,531	7,415	8,968	7,855	11,450
Cheyenne	22,474	31,935	43,505	41,254	47,207*
Laramie	10,627	15,581	17,520	23,143	24,339
Saratoga	810	926	1,133	1,181	2,420

Sources: Wyoming Department of Administration and Fiscal Control and U.S. Census Bureau, 1980 Preliminary Data.

*Note: Cheyenne city limits only; does not include total service area.

There have been several population projections made for areas within the study area. The population of the Sierra Madre area including Baggs, Dixon, Savery, Encampment, Riverside, and Saratoga is anticipated to increase from about 2,750 population in 1977 to 6,900 in 2000 (WRRI December 1979, p. B8,B9). This trend is expected to occur as a result of the development of energy related materials close to these towns. These areas may also begin exceeding available water supplies which are, except for Encampment and Riverside, extracted from the same drainage basin where the CBPU has permits for replacement water. Encampment and Riverside get their supplies from the North Fork of the Encampment River and private wells respectively.

Community growth in the Medicine Bow Mountains and Pole Mountain areas has not been estimated. Keystone, a resort community, uses groundwater for its domestic supplies. Keystone is located approximately two miles below the Rob Roy Dam. There is one subdivision planned for the Pole Mountain area and its water source is wells. The major community within these two areas is Laramie, which presently is independent of Cheyenne's surface water supplies.

The population within the Cheyenne water service is anticipated to increase from 53,375 people in 1980 to a range of 62,964 to 131,427 depending on the rate of growth by the year 2010 (see Table III-2 on the following page) 1/.

1/ Cheyenne water service area includes Cheyenne, Fox Farm and Orchard Valley subdivisions, and Warren Air Base; however Warren Air Base population was not included because it is classed and billed as an industrial, not domestic use.

TABLE III-2

POPULATION PROJECTIONS
CHEYENNE WATER SERVICE AREA

Projection	1980 Census[1]	1990	2000	2010
High	57,375	72,280	97,334	131,427
Low	53,375	57,829	59,594	62,964
Average[2]	53,375	65,054	78,464	97,330

1/ From: "Census Retrieval and Information Service," Wyoming Department of Administration and Fiscal Control excluding Warren Air Base, 1980, population 3,651 (DAFC).

2/ These average figures will be used for projections and establishment of need throughout the document. The average represents a midpoint projection between high and low projections.

Computation:

The base computations were derived using the same methodology as the Institute for Policy Research as described in "Cheyenne Water Project Feasibility" (WRRI, 1979, pp. B3-B6, Appendix I). The population figures alone were derived by multiplying the 1980 census figure by a percentage increase for each projection year. The percentages for Cheyenne were derived by dividing the actual 1980 figure by the projected 1980 figure (WRRI, 1979, pg. B10). This percentage is then multiplied by the population projection figures for 1985-2000 in each high and low category.

Example:

For the high projection - 1980 estimated population is 62,231 and the actual was 53,375.

$$\frac{53,375}{62,221} = .858 \text{ or } 85.8\%$$

85.8% x 1990, DAFC-IPR high projection (84,243) = 72,280

This method was repeated for each projection period and each for classification of high, low and average. This method took advantage of all sources and derivations previously used. Base figures for Wyoming were compiled on a federal level by the Bureau of Economic Analysis, and broken down for statewide use by the Wyoming Department of Administration and Fiscal Control(DAFC).

b. Economic Activity. The economy of the study area is based on agricultural and energy industries. Throughout Wyoming and the study area the energy industries have expanded and will continue to be a major industry. Mining and energy exploration have attracted workers from out of state into the area.

Recreation and tourism constitute a significant portion of the economic base in the area. The general public travels to the National Forests for their scenic beauty and recreational opportunities. Medicine Bow National Forest lands also support the ranching community, grazing of cattle and sheep is permitted.

Approximately forty percent of the labor force is employed in sectors that provide goods and services. Thirty-two percent are employed in the public administration portion with the largest concentration located in Laramie and Cheyenne. Employment by major industrial sectors in the study area is shown in Table III-3.

TABLE III-3

EMPLOYMENT BY MAJOR INDUSTRIAL SECTORS, 1980 1/

Sector	Albany	Carbon	Laramie	Total
Agricultural	389	627	955	1,991
Mining	32	2,859	111	3,002
Construction	542	1,209	2,131	3,882
Manufacturing	533	446	1,734	2,713
Transportation	646	1,183	3,426	5,255
Retail Trade	2,268	1,787	5,681	9,736
Finance	380	255	1,401	2,036
Service	1,703	1,171	4,629	7,503
Public Administration	4,115	2,178	12,961	19,254
Other	651	731	1,949	3,331
TOTAL	11,260	12,464	34,978	58,702

1/ Wyoming Population and Employment Forecast Report DAFC, 1980, p. 24.

c. Schools. School facilities in the study area are generally adequate; however, they are experiencing an increase in students created by the influx of gas and mineral workers moving into the area. There is some overcrowding of the schools and the need for additional classrooms is increasing. Some communities have added new classrooms.

d. Health Services. Medical, dental, and associated services are available in the study area. The smaller communities of Dixon, Savery, Encampment, and Riverside do not have complete facilities and services available. Baggs and Saratoga have medical clinics which are able to provide general medical service. Baggs, however, does not have a fulltime physician at the clinic. The larger communities of Rawlins and Laramie have hospital facilities which also serve the smaller communities. Ambulance service is available to all communities. There is a lack of medical doctors in the study area. Health services have been impacted because of the sudden increase of families in the area.

e. Law Enforcement. Dixon and Savery contract with the Carbon County Sheriff's Department for police protection. The remaining communities have their own organized law enforcement services. The community of Baggs is augmented with a reserve force.

f. Fire Protection. All of the communities in the study area have organized fire departments with the exception of Dixon and Savery which are protected by Baggs. The communities have adequate fire equipment to serve existing needs; however, it is questionable whether some of the smaller communities would be able to serve a population increase.

g. Housing. The housing supply in the three-county area is composed primarily of owner-occupied single family units. Because of a substantial increase in population, rental units are scarce and, where available, the rent is high. The total number of housing units within the study area by county is shown in Table III-4.

TABLE III-4
TOTAL HOUSING UNITS

County	1970	1980	Percent Change
Albany	8,800	11,962	+ 35.9
Carbon	5,071	8,633	+ 70.2
Laramie	19,437	27,327	+ 40.6

Source: U.S. Census Bureau, 1980 Preliminary Census.

All of the communities have been affected by the many new families that have moved into the area because of the fossil fuel and mineral extraction industries. Mobile home parks have been developed to meet this housing need in the communities. Most of these parks are filled. Housing within the city of Laramie is impacted by university students during the fall and winter months. When school is in

session a rental shortage is experienced. During the summer months, more rental units are readily available in Laramie.

2. Hydrology

a. General

The proposed interbasin transfer of water and the conveyance of this water across several drainage basins creates a complex hydrologic situation because of the many streams involved. The streams which the proposed alternatives could affect are shown in Figure III-1. Diversion of water from the Medicine Bow Mountains involves Douglas Creek including Rob Roy Reservoir, Lake Creek, Lake Owen, and many smaller drainages. All of these are part of the North Platte River basin. The Middle Crow Creek drainage, which is used to convey and store these waters before use in Cheyenne, is part of the South Platte River basin. Some of the alternatives including the existing Stage I system involve replacement of North Platte River waters by diverting water from the Little Snake River which is part of the Colorado River drainage. The replacement water is diverted to the east side of the Continental Divide where it is stored in Hog Park Reservoir and released down Hog Park Creek into the Encampment River. The Encampment River flows into the North Platte River about 20 miles downstream from the mouth of Douglas Creek.

Like most mountain areas, the flows of streams affected by the proposed Stage II diversions are quite dependent on snowmelt runoff. Most of the runoff occurs in late April to early July as exhibited by a sharp increase in flows at the onset of snowmelt. Thereafter a somewhat less rapid decline occurs through late July and August with a steady low flow experienced throughout the fall.

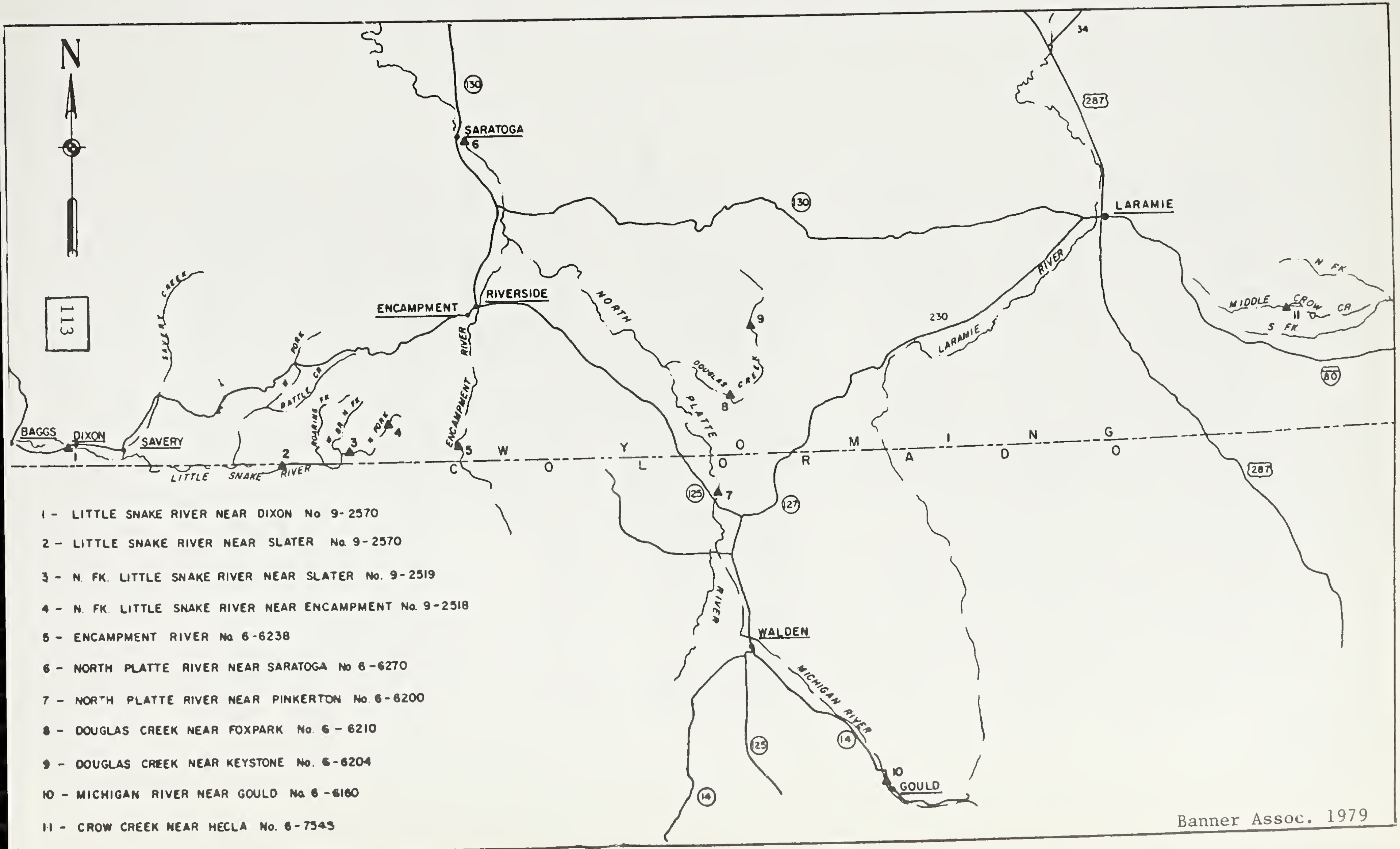
The annual low generally occurs from December through February. Besides these natural variations, flows are affected by irrigation diversions in some areas. These effects are most pronounced in August and September when natural flows are already quite low.

b. Douglas Creek

Douglas Creek drains the southwest portion of the Medicine Bow Mountains before emptying into the North Platte River about ten miles west of Keystone, Wyoming.

FIGURE III-1

DRAINAGES WHICH COULD BE AFFECTED BY STAGE II



Rob Roy Reservoir with a capacity of 8,895 acre-feet impounds and regulates the flows from the uppermost 21 square miles of the mountainous watershed as part of the Stage I diversion system. The average inflow is 24,725 acre-feet/year (34 cfs) of which about 84 percent occurs in May and June. (See Appendix III, p. III-6 for monthly flow data.) The existing reservoir is capable of yielding about 11,500 acre-feet/year, and Horse Creek near the existing Douglas Creek diversion structure located about one and onehalf miles downstream from the dam near Keystone yields another 1,500 acre-feet/year.

Farther downstream near Fox Park, Douglas Creek yields 54,000 acre-feet/year (75 cfs) from 120 square miles. (See Appendix III, p. III-7.) Flows vary from about 10 to 20 cfs during the non-snowmelt periods to an average of about 375 cfs during May and June.

c. Lake Creek

Lake Creek heads south of the Douglas Creek to Lake Owen pipeline. The stream flows in a southwesterly direction towards Douglas Creek which it joins about four miles south of Keystone, about 15 miles above the mouth of Douglas Creek. The Stage II diversion, as proposed by Cheyenne, would collect water from about 3170 acres of the upper watershed. The water would be discharged into Lake Owen.

Typical flows in lower Lake Creek, downstream from the diversion area, during the non-snowmelt period, are about two to three cfs. During May and June, flows are typically about 60 cfs.

d. Lake Owen and Middle Crow Creek

Lake Owen is a natural lake which was included in the Stage I System to relieve pressure and prevent surges in the pipeline system from Douglas Creek to Middle Crow Creek. Lake Owen was enlarged by a small earthen dam as part of the Stage I development. The reservoir, with a capacity of 750 acre-feet, receives water from the Rob Roy/Douglas Creek pipeline. From Lake Owen, the water is piped to Middle Crow Creek where it is released to flow downstream to the Granite Springs and Crystal Lake Reservoirs which are part of Cheyenne's Crow Creek water collection system.

Under natural conditions, Middle Crow Creek near the existing Stage I pipe outlet from Lake Owen had a peak annual flow of about 10 to 15 cfs during spring runoff, but was dry or nearly dry the remainder of the year. With the advent of Stage I, the peak flow has been increased to about 23 cfs with a base flow of about 11 cfs during the rest of the year. Under current Stage I operations, there is about a one-third gain in flows during spring runoff by the time the flows reach Granite Springs Reservoir about six miles downstream.

e. North Platte River

The North Platte River heads in Colorado just to the south of the project area and flows northerly to Casper, Wyoming, before turning southeasterly to flow across eastern Wyoming and western Nebraska to form the Platte River. The Platte River drains into the Missouri River near Omaha, Nebraska.

The waters of the North Platte River drainage have been heavily appropriated for irrigation and hydropower generation. Five major storage reservoirs have been constructed in Wyoming and one in Nebraska to make full utilization of flows. All waters of the North Platte River are appropriated except in unusually high runoff years.

The North Platte River at Northgate, Colorado, near the Colorado-Wyoming border, upstream from the project area, yields about 315,000 acre-feet/year (435 cfs) from a drainage area of 1,431 square miles.

Flows during summer snowmelt generally range from 800 to 1500 cfs. During the remainder of the year, typical discharges of 75 to 150 cfs are experienced.

Downstream from the project area near Saratoga just below the mouth of the Encampment River, the yield of the North Platte River increases to about 825,000 acre-feet/year (1,040 cfs) from 2,840 square miles. Flows during summer snowmelt range from about 2,000 to 6,000 cfs. During the remainder of the year, typical discharges of 250 to 500 cfs are experienced.

f. Little Snake River

The Little Snake River heads in the Sierra Madre Mountains on the west side of the Continental Divide along the Wyoming-Colorado border. Major tributaries of the Little Snake River in the proposed project area include the North, South and Middle Forks,

West Branch of the North Fork, and the Roaring Fork. The Little Snake River flows westerly from the project area crossing the Wyoming-Colorado border several times for the first 50 miles before turning southwest to join the Yampa River another 50 miles downstream. The Yampa River flows about 30 miles west before joining the Green River which becomes tributary to the Colorado River near Moab, Utah.

Unless prior rights to North Platte River flows are purchased, it would be necessary to replace any waters diverted from the North Platte River drainage. This applies to proposed diversions from Douglas Creek, Lake Creek, and miscellaneous smaller streams which would be diverted under Stage II. Alternative E includes purchase of repayment waters, while Alternative B and C include repayment of diverted waters with water from the Little Snake River drainage.

Streamflows in the Little Snake River and its tributaries are typical of mountain streams. Monthly average streamflow data for the North Fork Little Snake River, Little Snake River, and Yampa River are summarized in Table III-5. More detailed information is provided in the Appendix III, pp. III-9 to III-14.

It is evident that runoff is quite high during the May-June snowmelt, but rapid declines occur in July due to both lack of inflow and increased depletions for irrigation and other uses. In the upper end of the basin where there are no depletions, the annual

TABLE III-5

SUMMARY OF STREAMFLOW RECORDS

Location	Drainage Area (square miles)	Monthly Flows (cfs) Average	Highest	Lowest
N. Fork Little Snake R. near Encampment	12.8	19	99 (June)	2.5 (Feb.)
N. Fork Little Snake R. near Slater	29.3	38	174 (June)	5.0 (Feb.)
Little Snake R. near Slater	285	222	1044 (May)	28 (Sept.)
Little Snake R. near Dixon	988	471	2317 (May)	17 (Sept.)
Yampa R. below confluence with Little Snake R.		1995	8115 (May)	246 (Sept.)

low flow occurs in February and is only slightly lower than September flows. However, farther downstream near Dixon where there are substantial irrigation diversions, the lowest flows occur in September and are only 20 percent of the lowest monthly winter flows.

g. Hog Park Creek and Encampment River

Hog Park Creek is located on the east side of the Continental Divide directly across from the North Fork Little Snake River. Hog Park Creek is a short, steep stream which runs only about five miles easterly before emptying into the Encampment River. The Encampment River, which heads to the south just across the Wyoming-Colorado border, flows northerly from the junction with Hog Park Creek about 20 miles before joining the North Platte River between Encampment and Saratoga, Wyoming.

Hog Park Reservoir with a capacity of 2970 acre-feet and located about 2.8 miles upstream from the junction with the Encampment River was constructed as a part of Stage I to control erosion of the stream. Releases from Hog Park Reservoir are adjusted daily to replace water diverted to Cheyenne from the Douglas Creek . Natural flows are passed through. The natural flow of Hog Park Creek during the non-snowmelt seasons is only about two cfs. With Stage I in operation, this flow is increased to about five cfs. During May and June, the natural flow is about 90 to 100 cfs. Stage I contributes an additional flow up to 50 cfs during this period.

The Encampment River in the vicinity of Hog Park Creek has a flow of about 25 cfs during the non-snowmelt season and a flow of up to about 700 cfs during May and June. Near the mouth, base flows are about 50 cfs with snowmelt runoff peaks of about 2000 cfs.

h. Water Quality

There are two components of water quality that may be affected, turbidity and salinity. Currently neither is a problem within the proposal area. Salinity is a problem on the lower reaches of the Colorado River. The annual damage to crop production in Southern Arizona and California presently ranges from \$.00000 to \$.06660 per irrigated acre for each milligram per liter increase in salinity (Utah Water Research Laboratory, 1978). See Table III-6.

Additional studies done by the Bureau of Reclamation indicate a total damage figure of $469,000. per milligram of salts (Colorado River Salinity, USDI-WAPRS, December, 1980, p. 19, See Table III-7). This figure is tied to the concentration situation recorded at the Imperial Dam. These losses include industrial and municipal impacts to communities using Colorado River water for domestic purposes. In terms of 1976 dollars, municipal damages averaged $.1348 per household per milligram of salts (Colorado River Salinity, USDA-WAPRS, 1980, p. 19).

Between 1972 and 1980, flow weighted salinity concentrations have been shown to decrease 103 mg/l at Imperial Dam, California (Salinity Control Forum, 1980, p. 8). There were also decreases of 16 and 44 mg/l respectively at Hoover and Parker Dams during the same period. These figures are expected to fluctuate, and Tables III-8-10 show anticipated levels between 1985 and 1995 (Salinity Control Forum, 1980, pp. 19-21). The figures reflect both depletions from consumptive projects and basic projects which are directed at reducing salinity.

The water on the proposed construction area was tested for about twenty items and surpassed standards for all but heavy metal concentrations (Wyoming Department of Environmental Quality, 1979).

TABLE III-6

SALINITY CONCENTRATION IMPACTS IN THE LOWER COLORADO RIVER IRRIGATION DISTRICTS

Note: The following tabular data have been compiled from tables in "Salinity Management Options for the Colorado River," Utah Water Research Laboratory, Utah State University, 1978, pp. 136-205.

Irrigation District	State	Irrigated Acres	Total Annual Damage (Dollars)	Annual Per Acre Damages (Dollars)	Annual Damages Per mg/l (Dollars)	Annual Damages Per mg/l Per Acre (Dollars)
Coachella	Calif.	44,774	35,843	.80	71.69	.00160
Palo Verde	Calif.	95,189	1,326,909	13.94	2654.00	.02790
Imperial	Calif.	507,518	16,800,389	33.00	3360.10	.06660
Indian Reservation	Calif.	68,538	378,234	5.52	756.50	.01100
Coastal Region	Calif.	34,821	69,274	1.99	138.55	.00400
Wellton Mohawk	Calif.	68,379	165,339	2.42	330.68	.00480
Gila	Arizona	31,549	144,091	4.57	288.18	.00910
Yuma Valley	Arizona	57,973	375,417	6.48	750.83	.01295
Salt River Proj.	Arizona	165,942	0	0	0	.00000
Roosevelt #1	Arizona	36,196	0	0	0	.00000
Roosevelt #2	Arizona	31,368	5,409	.17	8.65	.00030
San Carlos (Non Indian)	Arizona	55,499	0	0	0	.00000
San Carlos (Indian)	Arizona	21,170	224	.01	.04	.00002

TABLE III-7

SALINITY IMPACTS - DAMAGE IN DOLLARS

Imperial Dam California
(Colorado River Salinity - USDI-WAPRS, December, 1980, p. 19)

Year	GNP implicit price deflator	Incremental direct + indirect impacts ($/(mg/l)
1976	133.7	343,000
1977	141.7	363,500
1978	152.0	389,900
1979	165.5	424,600
1980 1/	174.5	447,700
1980 2/	182.8	469,000

1/ First Quarter only

2/ Third Quarter only

It is recommended that the GNP Implicit Price Deflator be used for this purpose. Index values since 1976 are shown in the tabulation above. As an example, total benefits (damages) per milligram per liter in the first quarter 1980 would be $343,000.00 ($174.5 ÷ $133.71) = $447,700.00 (Colorado River Salinity - USDI-WAPRS, 1980, p. 19).

TABLE III-8 - PROJECTED 1985 SALINITY LEVELS

(mg/1)

Numeric Criteria: Hoover Dam 723, Parker Dam 747, Imperial Dam 879

Average virgin flow (maf)	Location	Without salinity control projects			With Three Authorized 1/ salinity control projects			With 12 1/ salinity control projects		
		Low depletion	Moderate depletion	High depletion	Low depletion	Moderate depletion	High depletion	Low depletion	Moderate depletion	High depletion
	Hoover Dam	739	743	747	736	740	744	736	740	743
13.0	Parker Dam	748	754	760	745	751	756	744	750	756
	Imperial Dam	903	913	931	899	909	927	898	908	926
	Hoover Dam	718	722	727	714	718	724	714	718	723
14.0	Parker Dam	724	730	737	721	727	734	720	726	733
	Imperial	851	862	889	847	858	885	846	857	884
	Hoover Dam	697	701	706	694	698	703	693	697	702
15.0	Parker Dam	702	708	715	699	704	711	698	704	711
	Imperial	809	819	844	805	815	840	805	814	839

* The Colorado River System is subject to highly variable annual flows which affect the river's salinity. Although reservoir storage tends to dampen the effects of variable flow, it is probable that actual salinity levels will exceed or fall below the values shown on this table even through the conditions upon which the projections are based, such as average virgin flow and future level of development, are met.

1/ Salinity control measures began in 1979 and measurable salt removal is estimated to occur in 1982. Other units are added periodically through 1995 when 12 of the 13 units are on-line. The thirteenth unit is added 1996. See Table III-7 for the initial year of salt removal for the individual units. The full impact of salinity control, in the lower main stem, is not realized until 1002 with the three authorized salinity control units and 2005 with the 12 units.

2/ Table extracted from Salinity Forum, 1980, p.19.

TABLE III-9 - PROJECTED 1990 SALINITY LEVELS
(mg/l)
Numeric Criteria: Hoover Dam 723, Parker Dam 747, Imperial Dam 879

Average virgin flow (maf)	Location	Without salinity control projects			With Three Authorized salinity control projects 1/			With 12 salinity control projects 1/		
		Low depletion	Moderate depletion	High depletion	Low depletion	Moderate depletion	High depletion	Low depletion	Moderate depletion	High depletion
	Hoover Dam	770	776	793	746	752	768	740	745	761
13.0	Parker Dam	781	789	809	756	763	782	749	757	775
	Imperial Dam	953	968	994	923	937	962	915	929	953
	Hoover Dam	742	750	766	720	728	743	714	722	737
14.0	Parker Dam	752	762	781	728	738	756	722	732	750
	Imperial Dam	918	935	960	890	906	931	882	899	923
	Hoover Dam	712	720	738	690	698	716	684	692	710
15.0	Parker Dam	720	730	750	697	707	727	691	701	721
	Imperial Dam	858	878	922	831	851	894	825	844	887

* The Colorado River System is subject to highly variable annual flows which affect the river's salinity. Although reservoir storage tends to dampen the effects of variable flow, it is probable that actual salinity levels will exceed or fall below the values shown on this table even through the conditions upon which the projections are based, such as average virgin flow and future level of development, are met.

1/ Salinity control measures began in 1979 and measurable salt removal is estimated to occur in 1982. Other units are added periodically through 1995 when 12 of the 13 units are on-line. The thirteenth unit is added in 1996. See Table III-7 for the initial year of salt removal for the individual units. The full impact of salinity control, in the lower main stem, is not realized until 2001 with the three authorized salinity control units and 2005 with the 12 units.

2/ Table extracted from Salinity Forum, 1980, p. 19.

TABLE III-10 - PROJECTED 1995 SALINITY LEVELS 2/
(mg/1)
Numeric Criteria: Hoover Dam 723, Parker Dam 747, Imperial Dam 879

Average virgin flow (maf)	Location	Without salinity control projects			With Three Authorized 1/ salinity control projects			With 12 1/ salinity control projects		
		Low depletion	Moderate depletion	High depletion	Low depletion	Moderate depletion	High depletion	Low depletion	Moderate depletion	High depletion
13.0	Hoover Dam	801	816	853	757	771	804	730	744	774
	Parker Dam	813	831	872	767	784	821	739	755	788
	Imperial Dam	992	1,018	1,070	937	962	1,008	904	927	969
14.0	Hoover Dam	772	787	818	733	747	776	710	723	751
	Parker Dam	783	800	835	742	758	791	718	734	764
	Imperial Dam	957	981	1,026	907	931	972	878	901	940
15.0	Hoover Dam	739	755	788	702	718	750	680	696	727
	Parker Dam	748	767	804	710	728	763	687	705	740
	Imperial Dam	898	932	988	853	885	939	826	859	911

* The Colorado River System is subject to highly variable annual flows which affect the river's salinity. Although reservoir storage tends to dampen the effects of variable flow, it is probable that actual salinity levels will exceed or fall below the values shown on this table even through the conditions upon which the projections are based, such as average virgin flow and future level of development, are met.

1/ Salinity control measures began in 1979 and measurable salt removal is estimated to occur in 1982. Other units are added periodically through 1995 when 12 of the 13 units are on-line. The thirteenth unit is added in 1996. See Table III-7 for the initial year of salt removal for the individual units. The full impact of salinity control, in the lower main stem, is not realized until 2001 with the three authorized salinity control units and 2005 with the 12 units.

2/ Table extracted from Salinity Forum, p. 19.

3. <u>Existing Uses of Water</u>

a. <u>General</u>

The only water supplies that could be adversely affected by the Cheyenne Stage II Water Diversion Proposal are those located in the Colorado River Drainage downstream from the proposed upper Little Snake River diversions. Water users on the east side of the Continental Divide would be unaffected or could even benefit. The proposed Stage II diversion would provide increased flows along the Encampment River and Middle Crow Creek, more stable flows along the Encampment River and Middle Crow Creek, more stable flows along the North Platte River, and increased flows in Crow Creek and the South Platte River downstream from Cheyenne's wastewater treatment plant. The only possible adverse effect on the east side of the Continental Divide is along Douglas Creek and the North Platte River between the Douglas Creek diversion and the mouth of the Encampment River where the water is replaced during high flow periods. Savage Ditch with a recorded senior diversion right of 100 cfs from Douglas Creek could be impacted. However, there is no evidence that the right has been exercised in recent years and is thus subject to abandonment proceedings. A few active appropriations for small amounts of domestic and irrigation uses exist along these two streams, but these would not be significantly affected.

The Little Snake River is part of the Colorado River system. The Colorado River system is the most heavily utilized in the nation. Besides extensive use for irrigation, the river supplies water to such metropolitan complexes as the coast of southern California, the eastern slope of the Rocky Mountains from Colorado Springs to Cheyenne, the Upper Rio Grande of New Mexico, and the Wasatch Front in Utah. Very little usable water of its 14.9 million acre-feet/year escapes to the Gulf of California.

The waters of the Colorado River system have been contested more than any in the country. They have been regulated since 1929 by the Colorado River Compact which divided the flows of the river between the upstream and downstream states. Under this and subsequent agreements, Wyoming was allocated about 1,000,000 acre-feet/year, a significant portion of which has not yet been developed. Because of Wyoming's right to develop this water and because of the minimal impacts which would occur downstream along the Little Snake and Yampa Rivers in Colorado, Green River

in Utah, and along the Colorado River, the remainder of this water use discussion will deal only with water uses in the project area and the 50 mile reach of the Little Snake River along the Wyoming-Colorado border.

b. Irrigation

Presently, the major use of water in the Little Snake River basin is for irrigation. The Wyoming Water Development Commission (WWDC) has estimated that 11,156.6 acres were irrigated in the Little Snake River basin in Wyoming in 1979. The following is a breakdown of irrigated lands by drainage.

Stream or Stream Reach	Actual Irrigated Acreage
Little Snake River:	
Three Forks to Slater Creek	40.0
Slater Creek to Savery Creek	156.3
Savery Creek to State Line	6,232.1
Other Streams not affected by Stage II:	
Savery Creek	2,240.4
Muddy Creek	717.5
Battle Creek	376.7
Miscellaneous Tributaries:	1,393.6
Total	11,156.6 acres

The U.S. Bureau of Reclamation (USBR) has estimated a weighted consumptive irrigation water use of 1.02 acre-feet/acre with a diversion requirement of 3.16 acre-feet/acre. The annual diversion requirement is 35,255 acre-feet/year. The diversion requirements on a monthly basis are listed in Table III-11, Appendix III. This figure of irrigated acreage is, however, less than the acreage under adjudicated and unadjudicated water rights. There are approximately 28,000 acres of water rights for irrigation use in good standing in the Little Snake River basin in Wyoming. However, only actual irrigated acreage is being used here in order to evaluate existing water usage demands.

The majority of irrigation is by direct diversion of streamflows. There is little or no storage to supply

supplemental water during the low flow period of late summer and early fall. Many of the streams dry up in August and September.

c. Municipal

Cheyenne currently diverts about 7,400 acre-feet/year from the Little Snake River drainage. The only municipal users of water that could be affected by Stage II withdrawals are Baggs and Dixon. Baggs with a current population of 430 obtains its water supply from an infiltration gallery in the Little Snake River. Dixon with a current population of 82 obtains its water by means of a direct diversion from the Little Snake River. Some Dixon residents also rely upon private groundwater wells. Baggs has finished water storage for 317,000 gallons, and Dixon has a finished water storage of 200,000 gallons. Neither community has raw water storage of any significance. Both communities can be adversely affected during extended periods of zero flow.

The average annual water usage for the Cheyenne water service area was 12,506 acre-feet for the years 1967 through 1978 (Wyoming State Engineer, 1978, p. 17, Appendix II, Section 5, Revised Draft Appendix). If wells are reserved for peak demand periods, Cheyenne's current consumption is equal to production capabilities. Both ground and surface water supplies are adequate at this time, meeting current demands. It is projected that with population growth, Cheyenne will need additional water supplies. An increased capability is necessary to meet these future demands.

There are estimates that consumer rates could more than double depending on the method of development. (See table, Summary of Environmental Impacts, at the end of Chapter IV.)

Cheyenne's water demand has varied over the last 10 years. Current trends indicate an overall decline in gallons per capita per day (WRRI, 1979, p. D-13, Appendix II, Section 1, Revised Draft Appendix).

The groundwater levels have dropped 20 feet in the Cheyenne well fields and the reliable production is 2,000 acre-feet per year (Banner and Associates, 1979, pps. I-1 and I-3). The existing water production is 14,700 acre-feet per year. This includes the groundwater Cheyenne wishes to hold for standby uses. (Wyoming Water Planning Program, 1978, pp. 5, 8, Appendix III, Section 5, Revised Draft Appendix.)

The State Engineer has issued water permits for the quantities of water proposed for diversion. Water quantities are sufficient to maintain viable fish populations in all but those streams which have Stage I diversions on them. These streams begin to recharge within 300 yards, however flows remain below normal several miles downstream.

4. Fisheries

a. North Fork and Roaring Fork of the Little Snake River Drainage.

The headwaters of the North Fork and Roaring Fork of the Little Snake drainage originate on the Continental Divide at 10,400 feet elevation. These small, high gradient streams flow south and westerly through large stands of subalpine fir, (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), quaking aspen (*Populus tremuloides*) and lodgepole pine (*Pinus contorta*) as well as moist mountain meadows before reaching the Little Snake River eight to ten miles downstream at an elevation of approximately 7,000 feet.

Colorado River cutthroat trout are predominant at higher elevations with brook trout, rainbow trout, cutthroat-rainbow hybrids and the mottled sculpin (*Cottus bairdi*) also found at lower elevations in some streams. Fish habitat in these small, high gradient streams consists mainly of small pools and shallow riffles with a few large pools also present. Beaver activity is very limited. Substrate is mostly rubble-boulder with intermixed patches of gravel. Large boulders dominate stream reaches with above average gradient. Data indicate that low flows during late summer, fall and winter limit various habitat parameters of the trout populations present including cover, reproductive success and possibly food production (Binns, 1977a; Jespersen, 1979; Wesche, et al. 1977). High water quality is consistent throughout the North Fork and Roaring Fork drainages. Benthic macroinvertebrates are the major food source for trout in the North Fork and Roaring Fork drainages. Samples collected from six streams in the North Fork drainage consisted of 70% Ephemeroptera (Mayflies), Plecoptera (Stoneflies), and Trichoptera (Caddisflies), and 20% Diptera (true flies) (Binns, 1977b).

The Colorado River cutthroat trout is indigenous to the North Fork and Roaring Fork drainages of the Little Snake River and historically was the only trout species present in these two drainages. However, these populations have been reduced by competition and hybridization with species which have been introduced into the Little Snake River and many of its tributaries. The competitive ability of the Colorado River cutthroat trout is questionable and this trout does best when other species are absent or at minimal levels (Binns, 1977b). Only brook trout were found in Sherard Creek, a tributary to the Roaring Fork, by Jespersen (1979). The West

Branch population of Colorado River cutthroat trout is extensively hybridized with rainbow trout (Binns, 1977b). Brook trout have also moved up the West Branch and represent a threat to the cutthroat population in this stream and its tributaries. The North Fork and its tributaries above the West Branch contain the largest population of essentially pure Colorado River cutthroat trout remaining (Binns, 1977b). These populations have been protected from upstream movement of other species by a fish barrier installed by the Wyoming Game and Fish Department in 1977.

The existing populations of Colorado River cutthroat trout in the North Fork, Ted Creek, and Green Timber Creek have declined from a loss of habitat associated with decreased streamflows since the completion of Cheyenne's Stage I diversion facilities in the early 1960's (Jespersen, 1979). There were no maintenance flows established below the Stage I diversion structures in the North Fork of the Little Snake River drainage. These structures annually dry up sections of streams immediately below the diversion with decreasing levels of impact as groundwater and small tributaries contribute water downstream. The average trout standing crop from 14 study areas sampled on streams affected by Stage I diversion was 17.06 pounds per surface acre, while the average trout standing crop from 14 study areas sampled on streams not affected by Stage I diversion was 46.33 pounds per surface acre (Jespersen, unpublished data).

Low flows below the Stage I diversion structures not only reduce the quantity of available trout habitat as a direct result of less water but also the quality of available habitat due to the relationship between the remaining flow and the stream channel.

Fish habitat can be quantified by "habitat units" of which stream flow is a critical factor. Habitat units are calculated from several environmental components (Appendix IV, Section 2 Revised Draft Appendix). As a result of no maintenance stream flows in the Stage I tributaries of the North Fork drainage, habitat for trout was reduced by 270 units. By requiring that maintenance flows be established in these streams as a part of Stage II, 252 of these units would be regained. Since these actions are attempts to return the streams to their original character and not to prevent or substitute for a reduction, the units regained were not considered in the overall trout habitat unit calculations in terms of a gain or loss.

The North Fork of the Little Snake River drainage remains as the last major stronghold for the Colorado River cutthroat trout. This is primarily due to the isolated nature of this drainage which has kept human contact and disturbance to the fish population at a minimum. Stage II construction would greatly increase human contact and disturbance to all streams in the North Fork drainage. This would have a range of effects on the trout population. Soil erosion resulting from construction would increase stream turbidity and sediment load during and after construction. This may affect reproductive success, feeding ability, macroinvertebrate production and fish distribution within the streams during this time period. This would increase stress on the trout population. New access and human contact would increase fishing pressure and the possibility of exotic species introduction.

Certain conditions and characteristics of this trout population indicate that construction activities and increased human contact could be severely detrimental to the population. These conditions and characteristics are discussed in detail in Jespersen (1979 and 1980) and are as follows:

- the poor condition of most trout in this population as determined by "condition factor" analysis based on length-weight relationships,

- heavy infestations by the external parasite *Gyrodactylus* sp. (flukes) found on trout from all streams in the North Fork drainage. Infestations of this nature are uncommon in natural populations and may result in high mortality. Stress is a major contributor to parasitic outbreaks,

- the extreme vulnerability of this cutthroat population to the angler. This population is unable to withstand even moderate fishing pressure,

- the inability of this subspecies to compete with other species,

- the limited amount of spawning habitat available in the North Fork drainage under natural conditions.

Because of these conditions and characteristics, it would be imperative that protective measures as listed in Appendix IV, Section 2, (Revised Draft Appendix) be implemented during and after construc-

tion to minimize construction impacts and to ensure that this population does not decline. The Forest Service will work with and make recommendations to the Wyoming Game and Fish Department concerning management practices which need to be implemented. These may include limited or no fishing and/or road closures during the construction period and following construction.

b. Hog Park Reservoir

Hog Park Reservoir was built for water storage and controlled release in Stage I of Cheyenne's water project. It was completed in 1964, has a maximum capacity of 3,000 acre-feet and a surface area of 175 acres. Brook, brown and rainbow trout are found in the reservoir. Located at an elevation of 8,400 feet, this reservoir requires annual stocking to maintain fishing success because of low productivity. The Wyoming Game and Fish Department presently stocks 25,000 fingerling rainbow in Hog Park Reservoir each year. Brook trout have also been stocked in the past. Spawning occurs in several small tributary streams adjacent to Hog Park Reservoir providing natural recruitment which maintains present brook and brown trout populations in the reservoir. There is no minimum pool guarantee in Hog Park Reservoir and surface area fluctuates from 175 acres to 60 acres annually. As a result of design, the reservoir cannot drain below 60 surface acres.

c. Hog Park Creek and the Encampment River

Water is released from Hog Park Reservoir into Hog Park Creek which flows into the Encampment River. Since 1964 when Stage I was completed, average annual flows in Hog Park Creek and the Encampment River have been increased 7,400 acre-feet. Due to the daily payback system, the majority of additional water in Hog Park Creek is during spring runoff when Rob Roy Reservoir is collecting water. This has resulted in an approximate 47% flow increase in Hog Park Creek during peak spring runoff (Banner and Associates, 1979). From the reservoir, Hog Park Creek flows 2.5 miles easterly through mostly open parks consisting of willows (*Salix* spp.), sedges, and grasses until it reaches the Encampment River at an elevation of 8,200 feet. Channel stability ratings conducted on lower Hog Park Creek by Wesche et al. (1977) and Stewart (1979) rated in the "good" category, indicating little if any long lasting detrimental effects associated with this increase in flow. In the upper part of Hog Park Creek below the reservoir, however, there are several areas where accelerated

bank erosion is occurring. The present Hog Park Creek channel is full during spring runoff.

Hog Park Creek contains good populations of brook, brown and rainbow trout. Data collected by Wesche et al. (1977) indicates that Hog Park Creek may also be an important spawning tributary for brown trout in the Encampment River. Benthic macroinvertebrates are the major food source for trout in Hog Park Creek. Sampling by Kimble and Wesche (1977) revealed the following taxonomic groups to be most abundant; Trichoptera (Caddisflies), Ephemeroptera (Mayflies), Plecoptera (Stoneflies), Coleptera (beetles), Diptera (true flies) and Mollusca (shellfish).

From the confluence of Hog Park Creek, the Encampment River flows northerly for 22 miles to the North Platte River. The Encampment River below Hog Park Creek flows through steep valley slopes covered with lodgepole pine, Douglas fir (Pseudotseuga menziesii), spruce and aspen. Substrate in this canyon type habitat consists mainly of large boulders and rubble (Wesche et al. 1977). The Encampment River supports an excellent brown trout fishery with brook and rainbow trout also found in small numbers. The Wyoming Game and Fish Department has classified this river as "very good trout water - fisheries of statewide importance." Channel stability ratings conducted by Wesche et al. (1977) and Stewart (1979) rated in the "good" category. The percentage flow increase in the Encampment River from Stage I water is much less than in Hog Park Creek and therefore not considered significant.

d. The Douglas Creek Drainage

The headwaters of the Douglas Creek drainage originate at 10,400 feet elevation. Douglas Creek and its tributaries flow south and west for 29 miles through spruce and pine stands at higher elevations which gradually change to willows, aspen, sagebrush and grassy meadows before reaching the North Platte River at 7,500 feet elevation. A dam was completed on Douglas Creek in 1966 creating Rob Roy Reservoir as part of Cheyenne's Stage I water project. Tributaries to Douglas Creek are small mountain streams of medium gradient experiencing low flows through late summer, fall and winter which data indicate are limiting to the trout populations present (Jespersen, 1980). Extensive beaver activity is found in the Douglas Creek drainage producing numerous ponds which provide habitat for larger trout on small streams, enhance overwinter survival and stabilize streamflows. Most beaver activity is limited to tributaries and headwaters of Douglas Creek.

The Douglas Creek drainage contains good populations of brook and brown trout with small numbers of rainbow trout found lower in the drainage. Nongame species include longnose suckers (*Catostomus catostomus*), white suckers (*Catostomus commersoni*), and long nose dace (*Rhinichthys cataractae*). The existing populations of brook and brown trout in Douglas Creek are affected by a loss of habitat associated with decreased streamflows since the completion of Cheyenne's Stage I diversion facilities in the early 1960's. There is also a small section of Horse Creek which was completely dry during the 1979 field season resulting from Stage I diversion. A one cubic foot per second flow requirement below the Douglas Creek diversion structure was the only stream flow requirement established for Stage I. This flow is considered very limiting to the trout population in Douglas Creek (Jespersen, 1980).

Fish habitat can be quantified by "habitat units" of which stream flow is a critical factor. Habitat units are calculated from several environmental components (Appendix IV, Section 2, Revised Draft Appendix). As a result of the one cubic foot per second, Stage I maintenance stream flow in Douglas Creek, habitat for trout was reduced by 559 units. By requiring that a 5.5 cubic foot per second maintenance flow be re-established in Douglas Creek as a part of Stage II, these 559 units would be regained. Since these actions are attempts at returning the streams to their original character and not preventing or substituting for a reduction, the units regained were not considered in the overall trout habitat unit calculations in terms of a gain or loss.

In addition to low flows, fish populations in Douglas Creek are subject to extreme flow fluctuations resulting from reservoir management which is considered detrimental to fish and macroinvertebrate populations (Jespersen, 1980). Trout standing crops reported by Wesche (1974) ranged from 7.5 to 183.1 pounds per surface acre at various distances below the Douglas Creek diversion structure. Trout populations sampled in proposed Stage II tributaries of Douglas Creek revealed standing crops ranging from 31.8 to 171.8 pounds per surface acre (Jespersen, 1980). Benthic macroinvertebrates are the major source of food for trout in Douglas Creek. Sampling by Binns (1976) revealed the following taxonomic groups to be most abundant: Trichoptera (Caddisflies), Ephemeroptera (Mayflies), Plecoptera (Stoneflies), Coleoptera (beetles) and Diptera (true flies).

e. Rob Roy Reservoir

Rob Roy Reservoir was built for water storage and controlled release in Stage I of Cheyenne's water project. It was completed in 1966, has a maximum capacity of 9,000 acre-feet and a surface area of 314 acres. Rob Roy Reservoir is the principal water collection facility in the Douglas Creek drainage, collecting water from approximately 21 square miles of mountain watershed. Located at an elevation of 9,400 feet, this reservoir requires annual stocking to maintain fishing success because of low productivity. The Wyoming Game and Fish Department has historically planted brook trout, rainbow trout and grayling in Rob Roy Reservoir. The present stocking policy is 25,000 fingerling rainbow trout each year. A natural population of brown trout is also found in the reservoir. Nongame species in the reservoir include white suckers and longnose suckers. Six tributary streams flow into Rob Roy Reservoir. These tributaries support naturally reproducing populations of brook and brown trout and also provide spawning areas for trout migrating out of the reservoir. Beaver activity on these tributaries is extensive. There is no minimum pool guarantee in Rob Roy Reservoir and surface area fluctuates from 314 acres to approximately 60 acres annually.

f. The North Platte River

There are approximately 28 miles of the North Platte River between the confluence of Douglas Creek and the Encampment River. This section of the river is of concern because it does not receive payback water for water diverted out of the Douglas Creek drainage. Fish habitat in this section of river is generally very good. The North Platte River is a meandering river with deep holes, undercut banks and good riparian vegetation along shorelines. Natural islands are common. The Wyoming Game and Fish Department is able to manage this section of the river as a wild trout fishery because of desirable habitat conditions in the river and good natural reproduction in many of its tributaries.

Good populations of brown trout and rainbow trout with a few brook trout and an occasional cutthroat trout are found in this section of the North Platte River. Nongame species include white suckers, longnose suckers, longnose dace, creek chubs, (*Semotilus atromaculatus*), Johnny darters (*Etheostoma nigrum*) and Iowa darters (*Etheostoma exile*). The Wyoming

Game and Fish Department has rated this section of the North Platte River as Class 1 "premium trout waters with fisheries of national importance". Recreation use on this part of the river is heavy and includes guided and private boat trips, fishing, floating and other recreational uses.

Stage I of Cheyenne's water project reduces flow in the North Platte River by diversion from Douglas Creek, one of its major tributaries. The diversion structure on Douglas Creek is located approximately 30 miles above its confluence and has removed an average of 7,400 acre-feet of water annually since the completion of Stage I in 1967. Mean monthly flows in the North Platte River have been reduced by no more than three percent as a result of Stage I diversion.

g. The Crow Creek Drainage

The headwaters of the Crow Creek drainage on Pole Mountain originate at 8,800 feet elevation and flow easterly for six to eight miles before leaving National Forest land. Ponderosa pine (*Pinus ponderosa*) stands dominate with lesser numbers of lodgepole pine and aspen also found in the drainage. Streams generally flow through wide willow bottoms broken up by frequent beaver ponds. Stream bottom substrate consists mainly of pebble size decomposed granite which is prevalent throughout the drainage.

Brook trout are found throughout the drainage with rainbow trout present in a few tributaries as a result of stocking. White suckers and creek chubs are also found lower in the drainage (McDowell, 1975).

Middle Crow Creek has been augmented by Stage I flows since the completion of Cheyenne's Stage I water project in 1967. This has increased peak spring flows from an average of about 13 cfs to 23 cfs at the discharge point on Middle Crow Creek (Banner and Associates, 1979). Middle Crow Creek presently flows at bankfull stages during spring runoff with accelerated bank erosion evident in several areas along the stream.

h. Colorado River Drainage

There have been no federally designated critical habitat or endangered and threatened fish species identified as being present within the immediate planned construction area of this proposal.

Downstream from the proposal site within the Colorado River drainage the following species have been identified as endangered:

<u>Gila cypha</u> - humpback chub
<u>Gila elegans</u> - bonytail chub
<u>Ptychocheilus lucius</u> - Colorado squawfish

Habitats for these species are found approximately 100 miles downstream from the proposal area in the Yampa River below the confluence of the Little Snake River. All are present in the section of the Yampa River that flows through the Dinosaur National Monument. This section of the Yampa is currently under study by the National Park Service for inclusion into the Wild and Scenic River system (National Park Service, Draft Environmental Impact Statement, Green & Yampa Rivers, 1979, p. 240).

The Yampa River has been determined to be one of the most important rivers for the survival of these species (National Park Service, Draft Environmental Impact Statement, Green & Yampa Rivers, 1979, p. 240). Their decline results from alteration of aquatic habitat through various water projects within the affected river basin(s) (National Park Service, Draft Environmental Impact Statement, Green & Yampa Rivers, 1979, p. 240).

5. <u>Recreation</u>

a. <u>Hog Park Reservoir, Lakeview Campground, and Boat Launch</u>. This reservoir is at the head of the system with a storage capacity of 2,970 acre-feet (Banner Supplemental Information 1979, p. I-7, Appendix III, Section 1, Revised Draft Appendix). There is a 35 unit campground and boat launch on the west shore of the reservoir. Much of the public use is lake fishing from shore and boat. Water levels fluctuate according to supply and Cheyenne's demand. Late season water levels lower to meet demands of Cheyenne. Fluctuations are not serious during the summer recreation season.

Enlargement of Hog Park Reservoir under Alternatives B, C and D from 175 to 695 acres would provide increased recreation opportunities for reservoir fishing and boating. The existing campground and boat launch would have to be relocated and replaced in kind. There are several suitable sites for these facilities, including areas for expansion if necessary. Access roads around the reservoir and to the developed recreation facilities would also have to be replaced.

The USDA Forest Service constructed the existing recreation facilities following development of Stage I. It is difficult to predict if enlargement of the reservoir will cause increased use and demand for more facilities. Much depends on the quality of the fishing and fluctuating levels of the reservoir. Therefore, the CBPU would not have to provide for a potential increase in recreation facilities.

b. Rob Roy Reservoir, Campground, and Boat Launch.

This reservoir is used for storage of water. The dam on Douglas Creek was built in 1961 as part of the Cheyenne Stage I system. This reservoir has a storage capacity of approximately 9,000 acre-feet (Banner Supplemental Information 1979, p. I-5). The reservoir is stocked with trout. The campground and boat launch facility is located along the north side of Rob Roy Reservoir. There is a 22 unit campground and a boat launch parking lot complex extending to the water's edge. Camping activities are water oriented with boating, reservoir fishing, and stream fishing. There is a road system along the north and west side of the reservoir.

Enlargement of Rob Roy Reservoir from 314 to 800 acres under Alternatives B, C, and D will also provide increased recreation opportunities for reservoir fishing and boating. As with Hog Park Reservoir, existing facilities must be replaced in kind. National Forest ownership is limited around Rob Roy Reservoir, but there are several sites suitable for replacement of the existing campground and boat launch with expansion if needed. In recent years recreation use has dropped at Rob Roy Reservoir. This is due to poorer fishing and reservoir drawdown during the summer season. Increased demand, if any, will depend on the quality of fishing and reservoir levels. It is therefore not proposed to expand existing recreation facilities until increased demand justifies it.

c. Vedauwoo Picnic Area and Campground. This is an 80 unit picnic and an 11 unit campground located on Pole Mountain. The Stage I pipeline skirts the south and east boundary of this area and empties water into a tributary of Middle Crow Creek at the northeast corner of the picnic area. Stream flows at Vedauwoo are sometimes erratic, from bank full to dry. When water is present, the area has more attraction than when dry. High flows occur during spring runoff and in the late fall. Middle Crow Creek, one to two miles below

Vedauwoo, is considered one of the major fisheries in the Pole Mountain area (Wyoming Game & Fish Consultations, 1979).

d. Lake Owen Campground and Boat Launch. Because Lake Owen would function as a pressure release reservoir for the pipeline system, there would be no change in the water level. The 37 unit campground and boat launch facilities would not be affected by any action alternative. Lake Owen is presently a very good trout fishery, and the recreation activities on and around Lake Owen would remain essentially unchanged.

e. Dispersed Recreation. There are several forms of dispersed recreation on the Medicine Bow National Forest. Land based recreation opportunities currently available are classed as semi-primitive (non-motorized), semi-primitive (motorized), roaded natural, and rural. There are private and commercial white water float trips taken on the North Platte River.

f. North Platte River Rafting. The white water boating season on the North Platte River begins about May 15 and lasts until about the first of July in any given year. Rob Roy Reservoir would fill in the spring and drop throughout the summer and fall. The time during the spring when Rob Roy is filling corresponds with the white water boating season on the above mentioned reach of the North Platte River.

Depending upon the distribution of flow during the May-June spring runoff period the white water boating period could be reduced especially during a low spring runoff year. In an average or better spring runoff period the impact to white water boating would probably be negligible.

6. Wilderness

RARE II areas identified for wilderness or further planning that could be affected by Stage II developments are:

a)	Platte River	-	C2080; 20,262 acres
b)	Encampment River	-	02086; 10,365 acres
c)	Huston Park	-	A2087; 31,485 acres
d)	Huston Park	-	C2087; 5,210 acres

Each area is described in Appendix III, p. III-17, Revised Draft Appendix.

7. Soils

There are 46 different soil mapping units [1/] in the construction area. The physical properties of these soils have a wide variation which will affect their response and behavior to different uses and activities. These properties and behavior evaluations are given in Appendix III, Table III-1, Revised Draft Appendix.

Most of the soils within the proposed construction area support vegetation and meet the cover requirements to stay below soil loss tolerances. Only existing roads and developments, including Cheyenne's Stage I development, have segments with less vegetative cover than recommended.

8. Range

The construction area involves four sheep allotments and five cattle allotments. These allotments currently support 3,126 sheep and 2,186 cattle between June 1 and October 1 (District Range Files: Hayden & Laramie Ranger District). All allotments have improvements such as water troughs, fences, stock driveways, or corrals associated with the management of the allotment. Table III-12 shows the individual breakdown by allotment. Those marked with an asterisk(*) are allotments within the proposal area where new construction could occur. The remainder fall within the area where the Stage I system is now located.

TABLE III-12

RANGE ALLOTMENTS

Allotment Name	Grazed Species	Number of Stock	Season of Use	Permittee(s) Number
*Roaring Fork	Sheep	1000	6/25-9/10	1
*Victoria	Sheep	1126	7/1-9/15	1
*North Fork	Sheep	1000	7/1-8/30	1
*Wood Mountain	Cattle	232	7/1-9/15	3
*Cinnabar Park	Sheep		7/11-8/25	Vacant
*Douglas Creek	Cattle	75	7/1-9/30	1
Fox Park	Cattle	808	6/16-9/30	3
Lodgepole	Cattle	571	6/1-10/15	3
*Green Mtn.	Cattle	500	6/1-10/15	2

1/ A soil mapping unit is a map unit consisting of a soil classification for which the soil is named, and it can include small units of other soils.

9. Wildlife

a. Sierra Madre Area

The Sierra Madre area includes the North Fork and Roaring Fork tributaries of the Little Snake River drainage on the west side of the Continental Divide, and the Hog Park Creek and Encampment River drainages on the east side of the Continental Divide.

Wildlife habitats found in this area are related to the various vegetation types present. These include the mountain big sagebrush type, silver sagebrush type, upland shrub type, aspen type, riparian-broadleaf type, lodgepole pine type and spruce-fir type. Elevations within this area range from 7,200 to 10,500 feet. Alpine and subalpine meadows are mixed with Engelmann spruce and subalpine fir stands at higher elevations. Lodgepole pine stands dominate middle elevations with quaking aspen often found on south and west exposures. Grass parks and wet meadows are found at all elevations with riparian vegetation concentrated along stream courses. Sagebrush and oak brush communities are common at lower elevations on the west side of the Continental Divide with sagebrush also common at lower elevations on the east side of the Continental Divide.

Elk and mule deer are common in the area with black bear and mountain lion also occurring. Bighorn sheep were reintroduced into the Encampment River drainage in 1976 and 1977 with recent sightings indicating use of the Continental Divide west to the Roaring Fork in Standard Park. The snowshoe hare, red squirrel, blue grouse and Columbian sharp-tailed grouse are also found in the area. Sage grouse may be found at low elevations in the Encampment River drainage. Numerous nongame species also inhabit or seasonally use the area (see Species List, Appendix III, Section 3, Revised Draft Appendix). Sandhill cranes have been sighted low in the North Fork drainage but not on National Forest land. Big game winter range for elk, mule deer and bighorn sheep is found at lower elevations in the Encampment River drainage.

Annual hunting seasons are established by the Wyoming Game and Fish Department for the game species mentioned above with the exception of the Columbian sharp-tailed grouse and bighorn sheep.

The Columbian sharp-tailed grouse, which is found at lower elevations, is listed as "sensitive" by the Wyoming Game and Fish Department. Bighorn sheep hunting has not been permitted in the Sierra Madre area but is anticipated in the future as the number of sheep exceeds optimum levels. Elk and mule deer are the primary big game animals harvested, with bow seasons beginning in early September and regular seasons opening in early and mid October..

b. Medicine Bow Mountains Area

The Medicine Bow Mountain area involved in this proposal includes the Douglas Creek and Lake Creek drainages on the west side of the range, Lake Owen and a corridor from Lake Owen across the Laramie plains on the east side of the range. The corridor crosses the south end of Sheep Mountain and follows the aqueduct from Lake Owen to Pole Mountain.

Wildlife habitats found in this area are related to the various vegetation types present. These include the sagebrush-grass type, aspen type, riparian-broadleaf type, riparian-conifer type, riparian meadow type, lodgepole pine type and spruce-fir type. Elevations within this area range from 7,200 feet to 10,200 feet. Engelmann spruce and subalpine fir stands dominate higher elevations gradually giving way to lodgepole pine at middle elevations.

Grass parks and wet meadows are found at all elevations with riparian vegetation concentrated along stream courses. Sagebrush-grass communities dominate at lower elevations with occasional aspen stands found in wet draws.

Elk and mule deer are common in the area with black bear and mountain lion also present. Bighorn sheep use certain areas in the Douglas Creek drainage. The snowshoe hare, red squirrel and blue grouse are found within the forested part of the proposal area with antelope, sage grouse and cottontail found within the corridor crossing the Laramie plains. Whitetail deer may be found where the pipeline corridor crosses the Big Laramie River. Numerous nongame species also inhabit or seasonally use the proposal area (see Species List, Appendix III, Section 3, Revised Draft Appendix).

Sheep Mountain is a Federal Game Refuge managed in cooperation with the Wyoming Game and Fish Department. Hunting is allowed on Sheep Mountain. The aqueduct would cross the south end of Sheep Mountain which is big game winter range for elk, mule deer, and antelope.

Annual hunting seasons are established by the Wyoming Game and Fish Department for the game species mentioned above. Elk and mule deer are the primary big game animals harvested, with bow seasons beginning in early September and regular seasons opening in early and mid October.

c. Pole Mountain Area

The Pole Mountain area which would be involved in this proposal includes the Middle Crow Creek drainage on the southern end of the Sherman Mountains.

Wildlife habitats found in this area are related to the various vegetation types present. These include the sagebrush-grass type, aspen type, riparian-broadleaf type, riparian meadow type, limber pine type and ponderosa pine type. Elevations in this area range from 7,400 feet to 8,800 feet. Ponderosa pine and limber pine stands dominate at high and mid-range elevations. Occasional aspen stands are found intermixed with riparian vegetation along stream courses and in wet draws. Wet and dry grassy meadows are common at all elevations. Sagebrush-grass communities are dominant at lower elevations.

Elk, mule deer, antelope, black bear, mountain lion, snowshoe hare, cottontail, red squirrel and blue grouse are found on Pole Mountain. Whitetail deer are occasionally found in the Pole Mountain area. Numerous nongame species also inhabit or seasonally use the area (see Species List, Appendix III, Section 3, Revised Draft Appendix). Hunting seasons for the game species mentioned above are established annually by the Wyoming Game and Fish Department. Elk and mule deer are the primary big game animals harvested, with bow seasons beginning in early September and regular seasons opening in early and mid October.

10. Visual Resource

There are two areas of outstanding visual resource quality. Hog Park has all the ingredients of an outstanding visual resource. The combination of open meadow and conifers, coupled with the flat mirror plane of water reflecting the scenic mountains in the background, provides contrast and variety of a high aesthetic quality. The area from the West Branch to Deadline Creek just below the proposed Huston Park Wilderness is also outstanding. The meadow, parks, vegetation, and rock outcrops provide a unique combination of variety.

11. <u>Cultural History</u>

Only about 50% of the Stage II project area has been included in completed cultural history inventories. A survey will be completed on the entire area in accordance with Executive Order 11593, and a release will be obtained prior to construction.

The National Register of Historic Places has been examined as well as the most current listing by the Wyoming State Historic Preservation Officer. There are no properties or sites listed within the proposed construction area that are on, eligible for inclusion, or recommended to be on the list.

12. <u>Tree Cover</u>

The tree cover consists of stands of pine, spruce, and fir. All occur mixed with aspen on selected sites. Depending on their stocking, size, and species, these areas are rated as commercial or noncommercial forest land. Between 0 and 764 acres of forest land would be affected, depending on the alternative selected.

13. <u>Transportation</u>

There are roads extending to the east boundary of the proposed collection area in the Sierra Madre Mountains. This includes roads linking Hog Park, Rob Roy, and Pole Mountain to surrounding communities of Encampment, Albany, and Laramie.

These roads are limited to snow free season use due to their elevation. They become snowed in around November first and are closed until late June except in the Pole Mountain area where roads open up in late April or early May.

There is a road along the Stage I facilities used for permit and other resource administration. The network of roads is a part of the Forest Service transportation system.

14. <u>Geology</u>

The Sierra Madre Mountains portion affected by the proposed action consists of Precambrian igneous and metamorphic rocks which predominate, and some cretaceous and Tertiary sedimentary rocks. Elevations range from 7,200 feet to 10,500 feet. There have been no recorded earthquakes near Hog Park Reservoir. Some of the reported disturbances at Rob Roy could have been felt at Hog Park. There has been no seismic damage reported at Hog Park Reservoir.

The Medicine Bow Mountains portion affected by the proposed action consists of Precambrian igneous and metamorphic rocks. Elevations range from 7,200 feet to 10,200 feet. There have been earthquakes reported in the Rob Roy Reservoir area. There have been four occurrences within 100 miles of the reservoir since it was built. The tremors rated from 3.8 to 4.4 on the Richter scale at their epicenter. There has been no reported damage to the Rob Roy dam or its associated structures as a result of these tremors (Woodward and Clyde, 1977, pp. C8-C17, Appendix III, Section 4, Revised Draft Appendix).

The Pole Mountain portion affected by the proposed action consists of Precambrian Sherman Granite. Elevations range from 7,400 feet to 8,800 feet. Surface geology consists of residuum and colluvium, alluvium/colluvium, alluvium and some glacial deposits. Valleys are "V" shaped; valley bottoms are generally narrow and interfluves are rounded.

15. Minerals

There are numerous mineral claims located below the proposed high water line of Rob Roy Reservoir and along the proposed pipeline route. There are placer claims located below proposed diversion areas in the Lake Creek drainage. These claims will have to be released prior to any construction.

16. Wetlands

Wetlands surround both Hog Park and Rob Roy Reservoirs. The following species composition exists at both reservoirs.

Species composition along streams
Dominants: *Salix spp.* (willow)
Carex spp. (sedge)
Subdominants: *Caltha leptosepela* (marsh marigold)

Species composition in adjacent wet meadows
Dominants: *Carex spp.* (sedge)
Deschampsia caespitosa (hairgrass)

Species composition in montane seeps and moss bogs
Dominants: moss
Caltha leptosepela (marsh marigold)
Subdominants: *Juncus sp.* (rush)
Potentilla glandulosa
Carex spp. (sedge)
Salix spp. (willow)

Approximately 67 acres of wetlands would be lost at Hog Park Reservoir due to inundation and borrowing of fill material for use in heightening of the dam. About 192 acres of wetlands at Rob Roy Reservoir would also be inundated due to enlargement of the reservoir.

Loss of these wetlands would adversely affect wildlife such as deer, elk, beaver, several species of birds, and small mammals. The project would destroy nesting, spawning, cover, and forage areas for resident and migrating wildlife. Loss of these wetlands would force wildlife to go elsewhere. In doing so, overcrowding, competition for food, and possibly disease and eventual death could occur.

17. Air Quality

Documents relating to the proposed action were submitted to the Air Quality Division of the Wyoming Department of Environmental Quality (DEQ). They have determined that the proposed action and alternatives are in conformance with the State Implementation plan for the National Air Quality Act) Appendix III, p. III-47, DEQ letter, Revised Draft Appendix).

IV. ENVIRONMENTAL CONSEQUENCES

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IV. ENVIRONMENTAL CONSEQUENCES

A. OVERVIEW

This chapter presents the economic, socioeconomic, resource management and resolution of public issues capabilities of the proposed action and alternatives. These items are discussed under Section B "Resource Element Impacts," and are the same resource or management concerns presented in Chapters I, II and III.

Items discussed in this chapter are presented in accordance with CEQ Regulations 40 CFR 1502.6 (Environmental Consequences parts a-h). An effort has been made not to duplicate the comparisons made in Chapter II of this EIS. The only duplication is that the discussion of the resource elements in this section fully describes those elements found in the Summary of Environmental Impact table at the end of Chapter II. There is a more complete description of each of these resource elements presented in Sections 1-8 of Appendix IV, Revised Draft Appendix.

The estimated effects discussed in this chapter provide the information necessary to compare the relative merits of the proposed action and the alternatives. The table Summary of Environmental Impacts graphically displays these effects.

The "Short Term Use and Long Term Productivity" are displayed as Section C of this chapter. Those impacts which result in a high degree of permanency such as roads and pipelines will be summarized in Section D, "Irreversible and Irretrievable Commitment of Resources," of this chapter. Any impact not mitigated fully can be found in Section E, "Summary of Probable Adverse Environmental Effects That Cannot be Avoided."

B. RESOURCE ELEMENT IMPACTS

1. Alternative A: NO ACTION

a. Economics

This alternative would continue to supply Cheyenne with 7,400 acre-feet of water annually from the Stage I system for a total of 14,700 acre-feet from all sources. The only increase in costs to the CBPU or the consumer would be those which could occur as system maintenance costs increase.

Based on 1980 dollars Cheyenne consumers are paying \$.87 per 1,000 gallons or \$294 per acre-foot for the first 250,000 gallons. Once a consumer exceeds 250,000 they pay \$.60 per 1,000 gallons or \$203 per acre-foot. The CBPU cost is \$.29 per 1,000 gallons

or $97 per acre-foot. Annual maintenance costs are $50,000. Approximately 14,700 kilowatts of electrical power are consumed in system maintenance.

Permit administration costs to the Forest Service would be $620 for a routine annual inspection of facilities. Detailed inspections of dam sites would be performed by the Army Corps of Engineers every five years. Annual inspections would be conducted by Banner Engineering of Laramie. The Forest Service would participate.

The term of supply could extend to 1990 depending on the rate of consumption, whether specific conservation methods were employed and the rate of growth.

b. <u>Resource Management</u>

There would be no additional effects on turbidity or salinity within the Colorado River system. The seven Colorado River cutthroat streams, two brook trout streams and 21 nonfishery tributary streams in the North Fork and Roaring Fork of the Little Snake drainage would not be diverted. The four brook and brown trout streams and 12 nonfishery tributary streams in the Douglas Creek drainage would not be diverted. Population and habitat loss due to construction, reduced flows and greater access would not occur. Hog Park and Rob Roy Reservoirs would not be enlarged. Therefore, 9.7 miles of naturally reproducing brook and brown trout streams would not be inundated. The lower reservoir in the Little Snake drainage would not be built eliminating the need to inundate 4.9 miles of naturally reproducing cutthroat, rainbow, and brook trout habitat.

The Stage I diversion system would remain in its present status. Maintenance flows would not be provided below the Stage I diversion structures in the North Fork of the Little Snake River drainage. The flow below the Douglas Creek diversion structure would remain at one cubic foot per second (cfs).

Recreation opportunities would remain in current proportions with the exception of the 5,210 acre Area IV described in the Huston Park Land Management Plan. It would be recommended for wilderness along with Area I immediately to the north.

The dams, roads, pipeline and diversion structures would not be present and there would be no further reduction in the visual quality of the existing landscape. Areas not satisfactorily revegetated in Stage I would remain in their current state.

There would be no additional wildlife benefits or losses. Wildlife habitat would not be inundated by reservoir enlargement on establishment; road and pipeline construction would not occur; and new access roads would not be provided. Consumptive and nonconsumptive wildlife and fish user days are presently estimated at 1,100 and 100 days in the proposal area west of the Continental Divide and would not be affected.

There would be no additional pipelines. The road system would remain at the lengtn of five miles needed to service the current system. The transportation system linking the affected areas would not change. There would be no increased maintenace costs to the counties or the Forest Service. There would be no need to relocate the 6.9 miles of road around Rob Roy and Hog Park Reservoirs including the Lakeview and Rob Roy Campgrounds. Current road and trail use patterns would not be affected and few increased demands would be put on the system.

c. Socioeconomic Impacts

The proposed project sites would be left undisturbed and, therefore, there would be no change to existing noise levels.

Population growth would most likely continue in the Cheyenne service area; however, water usage will be limited by its availability without the Stage II Water Diversion Proposal. Cheyenne's ability to meet future water demand, as influenced by its population growth, would be restricted. In addition to the population served and the increase in growth rates, there are other variables which will influence demand in the future. These include climatic changes, the cost of water and its rate structure, per capita income, and voluntary water conservation.

There is the possibility that new industry would develop in Cheyenne and this may result in an increase in industrial water demand. New industry would probably result in an increase of families moving into the Cheyenne service area. This would bring about an increase in water demand for nonindustrial use. The CBPU would have difficulty meeting these future water demands without the Stage II Water Diversion Project. Cheyenne may have to take measures to alleviate future water demands imposed by its growth; instituting a conservation program, a water rationing plan or imposing an increase in the cost as well as changes in the rate structure to discourage high water use.

With a lack of available water in the Cheyenne service area, new industry could decide not to locate in the area. There is the possibility that this would erode Cheyenne's tax rolls. Cheyenne may not realize an increase in property values if water demands cannot be met.

There would be no impact to farmland or ranches in the study area, and no significant impact on agricultural production.

d. State and County Plans

This alternative would not affect the state and county plans except in those areas of water management by limiting development options.

e. Public Issues

This option would favorably address public issues except for the provisions increasing flows in Stage I streams to maintenance level, water supplies to other communities, and development of compact allocated water. The role of water conservation in this alternative would be important in providing a continued water supply for the short term. Substantial growth in both the residential and industrial sectors could be limited. The remainder of the issues originated because of potential adverse effects from other than a no action alternative.

2. Alternative B: PERMIT CHEYENNE BOARD OF PUBLIC UTILITIES PROPOSED FACILITIES WITH MITIGATION

a. Economics

Alternative B would increase the amount of water to Cheyenne by 19,500 acre-feet providing a total of 34,200 acre-feet from all sources. With all costs based on 1980 dollars, the cost to the consumer would be $2.33 per 1,000 gallons or $790 per acre-foot for the first 250,000 gallons. Once a consumer exceeds 250,000 gallons they would pay $1.61 per 1,000 gallons or $545 per acre-foot. The CBPU cost would be $1.16 per 1,000 gallons or $393 per acre-foot. The cost to construct the system is estimated at $100,355,000.

It would cost approximately $126,500 annually to maintain diversion structures, access roads, and pipelines; operate flow releases; and treat water. Annual energy consumption for operation has been calculated at 14,700 kilowatt hours.

Forest Service administrative costs during construction would be approximately $62,000. These costs include a project liaison officer and a crew to mark timber for removal from the right-of-way and along the feathered clearing edges.

Administration of occupancy documents would consist of inspecting roads, pipelines, and collection structures twice a year. This would cost $990. Detailed inspections of the dam site would be conducted by the Army Corps of Engineers every five years. Annual inspections would be conducted by the permittee, or its representative, and the Forest Service.

The term of supply could vary from year 2010 to beyond 2070 depending on the rate of consumption, conservation practices and rate of growth (See Graph II-1, p. 55.) The data base for economic feasibility is in Appendix III, Revised Draft Appendix, "Itemized Costs". The term of supply could be adjusted favorably with water conservation. Using less water could then result in a dollar savings to consumers. The city could also realize a savings by not having to process the extra amount.

b. <u>Resource Management</u>

Complete development would be allowed in the North Fork and Roaring Fork of the Little Snake River drainage and in the Douglas Creek drainage. This would include diversion structures on nine fishery and 21 nonfishery streams in the Little Snake River drainage and on four fishery and 12 nonfishery streams in the Douglas Creek drainage. Rob Roy and Hog Park Reservoirs would be enlarged. Additional Stage II water would be released into Hog Park Creek and the Encampment River on a modified release schedule to prevent channel damage and fish habitat loss. A pipeline would be required to transport water off of National Forest land on Pole Mountain instead of allowing additional water to be released into Middle Crow Creek which would cause channel damage and fish habitat loss. The Stage I diversion structures in the North Fork of the Little Snake River drainage would be modified.

The average annual flow of the Little Snake River near Slater (the uppermost gage on the Little Snake River) would be decreased 12.2 percent by the 19,500 acre-feet/year Stage II diversion. (See Table IV-1 in Appendix IV.) Based on operation studies conducted by Banner Associates, Inc., (1981) for the 1940 to 1978 hydrologic period, the annual flow reductions would range between 9 and 16 percent at Slater with

the highest depletion percentages occuring in dry years. For the Little Snake River near Dixon the average annual flow would be decreased 5.7 percent. On the Yampa River below the mouth of the Little Snake River, the annual flow reduction would only be 1.2 percent, which is less than the accuracy of streamflow measurements and would not be discernible.

The following is a breakdown of the 19,500 acre-feet average annual depletion by month expressed as a percent of Little Snake River average monthly flows near Slater and Dixon.

Stage II Depletions at Downstream Locations by Month

Month	Proportion of Flow Depleted by Alternative B (%)	
	Little Snake River near Slater	Little Snake River near Dixon
Nov	7	3
Dec	7	3
Jan	5	2
Feb	5	1
Mar	4	1
Apr	2	1
May	13	6
Jun	18	10
Jul	3	3
Aug-Oct	0	0

For the Slater gage, these depletions would range from a high of 18 percent in June to none in August, September, and October. Farther downstream at the Dixon gage, the percentage depletions would be about halved. The high proportion of depletions in May and June is not surprising since 94 percent of the Stage II water would be diverted during these two months.

There is more than sufficient water in the Little Snake River for municipal and agricultural uses during the months when Stage II would be actively diverting. The critical period is late summer and early fall when Little Snake River flows decrease to almost nothing. Although Stage I flows have not been regulated by the Wyoming State Engineer, there is reason to believe that the much larger Stage II diversion would be regulated since streamflows during this period are not adequate to serve senior downstream water rights in most years. Such regulation

could be anticipated in early July. Even if not regulated, minimum flows requirements (11 cfs) for aquatic life downstream from the diversion dams would normally lead to a shutdown in early August. If, as anticipated, the Stage II facilities are shut down in early July the only significant effect will be to reach the shutdown date one to two days earlier.

Stage II development under Alternative B would increase salinity at downstream locations but the impact would be relatively small. Salinity would be increased about 3.1 mg/l at Baggs and from 1 to 2 mg/l at downstream locations. (See Table IV-2, Appendix IV.)

Erosion from the diversion dams, pipelines, and access roads construction will contribute to downstream turbidity. Baggs has experienced problems in the past with sediment clogging their infiltration gallery. The problem would be further aggravated under Alternative B.

The Forest Service's proposed payback schedule from Hog Park Reservoir would establish a 15 cfs minimum release and a 200 cfs peak release. (See Appendix II, Section 14, Revised Draft Appendix). The minimum release would be about 11 cfs higher than natural flows in lower Hog Park Creek and about eight cfs higher than Stage I modified flows. The maximum release would be about 100 cfs greater than natural flows and about 55 cfs greater than Stage I modified flows. The higher peak flows would initially cause some bank erosion and flooding along lower Hog Park Creek, as the scheduled releases in conjunction with natural attrition to streamflow downstream from the dam may, in some locations, exceed the 200 to 300 cfs channel capacity. From a fishery standpoint, the flow augmentation during low flows would more than offset any damages during high releases.

Along the Encampment River below Hog Park Creek, the proposed releases would as much as double natural streamflow during the nonsnowmelt period and result in up to about a 25 percent increase during the snowmelt period. The increase in releases, particularly during the low flow periods, would be beneficial to the trout fishery, agriculture, and other uses of the Encampment River.

The principal impacts on hydrology of the Douglas Creek-Lake Creek area would be downstream from the Douglas Creek diversion dam. These impacts were

assessed from operation studies conducted by Banner Associates, Inc. (1981) for the 1947 to 1971 hydrologic period. During hte snowmelt period, the impact would be mostly beneficial as the 5.5 cfs minimum release requirement downstream from the Douglas Creek diversion would in most years result in small to no reductions in flows from August to November and from 55 to 80 percent increase from December to March. In exceptionally dry years, the minimum release requirement would in worst cases result in triple the natural flows to the benefit of downstream aquatic life. The proposed 5.5 cfs minimum release compares with a Stage I minimum release of 1 cfs. At the Foxpark gaging station located about 10 miles downstream, the effects of operation of the Douglas Creek, Horse Creek, and Lake Creek diversion systems in most years would be essentially nil from August to November and increase streamflows 15 to 25 percent from December to March, again because of the 5.5 cfs minimum release requirement downstream from the Douglas Creek diversion. Essentially all diversions would occur from April to July resulting in a 55 to 95 percent flow reduction at the diversion dam in most years and up to 50 percent flow reduction at Foxpark after provision of minimum releases and flushing flows.

Most of the hydrologic impact to the North Platte River would occur between the mouth of Douglas Creek and the mouth of the Encampment River where diverted Douglas Creek flows are replaced. Operation of the Douglas Creek diversion system would increase flows up to four percent during the nonsnowmelt season and reduce flows about 10 to 15 percent during the snowmelt period. The 14 adjudicated water rights (through 1972) with accumulated diversion rights of 43.47 cfs would not be significantly affected by the Douglas Creek diversions.

Downstream from the mouth of the Encampment River, the annual payback schedule would have a stabilizing effect on flows of the North Platte River. Between October and early April in most years, the streamflow of the North Platte River at Saratoga would be increased five to ten percent while little change would occur in latter July, August, and September. Flows would be reduced about two to four percent from late April to early July when large diversions of snowmelt runoff are made from the Douglas Creek system.

Maintenance flows would be provided in all Stage I and Stage II streams in both the Little Snake and Douglas Creek drainages. This includes maintenance and flushing flows in all streams supporting fish populations and a blanket minimum flow in all non-fishery streams to maintain riparian habitat and seasonal reproductive use by trout populations. The flow below the Douglas Creek diversion structure would be increased from one cfs to 5.5 cfs.

Providing maintenance flows in Stage I streams would replace 252 Colorado River cutthroat trout habitat units in the North Fork of the Little Snake River drainage and 559 brook and brown trout habitat units in Douglas Creek which were lost due to inadequate stream flows. The table, Summary of Environmental Impacts, graphically displays the net effects this action alternative with mitigation would have on trout habitat units. 1/

The natural flow regime in Stage II streams would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur. These include a total net loss of 39 Colorado River cutthroat trout habitat units, and a loss of eight brook trout habitat units in the Little Snake drainage. A net loss of 121 brook and brown trout habitat units would occur due to the inundation of 5.8 miles of trout stream above Hog Park Reservoir. There would also be a loss of 280 brook and brown trout habitat units from the inundation of 3.9 miles of trout stream above Rob Roy Reservoir. A loss of 18 brook and brown trout habitat units would occur in Stage II streams in the Douglas Creek drainage.

Additional adverse impacts associated with construction and access which were not quantified in trout habitat units would occur with diversion of seven Colorado River cutthroat trout streams and two brook trout streams in the Little Snake drainage and four brook and brown trout streams in the Douglas Creek drainage.

1/ A trout habitat unit is defined as the amount of habitat quality required to produce an increase in trout quality standing crop of one pound per surface acre (Binns, 1976).

Hog Park Reservoir and Rob Roy Reservoir would be increased by 520 and 487 acres respectively. The dams would be increased in height by 50 feet. Geological technical surveys on both reservoir sites were conducted both by Woodward and Clyde Engineering in 1979. Their findings revealed both sites suitable to support the increased size of the dams including the required stipulations on the design (Woodward and Clyde, 1979).

Currently Banner and Associates are completing an analysis of flood potential below the Hog Park and Rob Roy Reservoirs should a breach occur. Any questions regarding dam designs would be resolved between Banner Engineering and the Forest Service Engineer.

Reservoir enlargement could increase fish stocking needs. Flow enhancement in Hog Park Creek, the Encampment River and the South Fork of Middle Crow Creek would provide an estimated gain of 0, 224 and 239 habitat units respectively as mitigation. Fishery impacts are discussed further in Appendix IV, Section 2, Revised Draft Appendix, "Fisheries".

Turbidity would not exceed state standards except under extreme climatic conditions. After approximately five years, turbidity would return to current conditions when vegetation is established on disturbed sites. Salinity could increase 1.89-2.17 milligrams of solids per liter of water (mg/l) measured at the Imperial Dam in Arizona. Current damage estimate is $469,000/mg of salt. (See Table III-7, p. 120) For this alternative the damage range would be from $886,410 to $1,017,730 at Imperial Dam. Salinity at Imperial Dam has decreased 100 mg/l since 1973 (Salinity Control Forum, 1980, p. 19). Detailed analyses of this alternative's impact and a complete data base are available in Appendix IV, Section 1, Revised Draft Appendix, "Watershed".

Two alterations to the dispersed recreation opportunities would be construction of additional roads and the enlargement of Rob Roy and Hog Park Reservoirs. Additional access in the Little Snake River sector would alter opportunities from semi-primitive motorized and nonmotorized types to a rural or roaded natural experience. This would occur because of increased use by modern highway type motor vehicles. This area currently has 8,400 acres available to off highway types of motorized and nonmotorized recreation. The area would become accessible

by highway vehicles. For further information, see Appendix IV, Section 8, Revised Draft Appendix, "Recreation and Wilderness."

Lakeview and Rob Roy campgrounds would have to be relocated and at the expense of the proponent. There would be no adverse effect on capacities because they would be replaced by the same size facilities. The only change would be use patterns. The enlarged reservoirs could cause an administrative impact in terms of controls needed to keep use within the limits of carrying capacity.

The 5,210 acre Area IV, within the Huston Park Management Unit would be managed as nonwilderness under this alternative. Flow regimes would be established to protect the Encampment and Platte River recommended Wilderness Areas. There would be 62,112 acres, instead of the 67,322 available for possible inclusion as wilderness under the no action alternative.

This alternative would disturb the soils on about 2,675 acres of forest land. These disturbances would include road construction, pipeline right-of-way clearing, and reservoir clearing associated with increased water levels. Borrow pits, spillway waste, and other waste disposal areas are located within the area to be inundated by the reservoirs. Mass land failure potential on 714 acres would be present primarily between West Branch and Roaring Fork. Within this corridor there are about 587 acres that are identified as having a very low revegation potential. Total evaluation of these parameters and the soil survey is available in Appendix IV, Section 4, Revised Draft Appendix, "Soils".

This alternative would affect ranchers in the Hog Park and Rob Roy areas who are permitted to graze livestock. It would also affect wildlife forage. The 1,007 acres lost by inundation would cause a reduction of 447 AUM's in grazing capacity for livestock and wildlife.

Wildlife habitat would be lost due to reservoir enlargement and road construction. Enlarging Hog Park Reservoir would result in 182 acres of conifer, 328 acres of grass and 10 acres of riparian habitat inundated. Enlarging Rob Roy would result in 280 acres of conifer, 27 acres of grass and 180 acres of riparian habitat inundated. The construction of 22.7 mile of road from Rose Creek to the Roaring Fork would remove 45.4 acres from production.

Relocation of 3.0 miles of road around Hog Park Reservoir and 3.9 miles around Rob Roy Reservoir would result in a loss of 10.9 and 14.2 acres respectively. The 6.6 miles of new road in Lake Creek drainage would be temporary road because adequate access roads already exist. Other roads needed would follow the existing Stage I right-of-ways. Total habitat loss with this alternative due to reservoir inundation and road construction would be 1,078 acres.

Riparian habitat loss would result from reservoir inundation and construction activities within riparian zones adjacent to streams proposed for diversion. The loss associated with streams to be diverted would be limited to the immediate construction zone since maintenance flows are required.

This alternative would not result in a loss of any of the game or nongame species presently found within the proposal area. There would be no effect on the Encampment River big game winter range since construction would not occur in or near this area. Construction activities within the right-of-way across the Sheep Mountain big game winter range would be restricted to periods when this area is not used as winter range. Vegetation disturbance and loss in this area would be temporary as is evident from previous construction activities associated with Stage I across Sheep Mountain. Due to the location of construction activities, this alternative would not affect bighorn sheep, Columbian sharp-tailed grouse or sandhill cranes. Maintenance flow requirements will maintain habitat at existing levels for furbearers and waterfowl which may use some of the streams proposed for diversion.

Wildlife within or near the construction zone would relocate or be temporarily displaced during construction activities. Although new access roads would not restrict big game movement, elk and deer may adjust movement patterns across such roads. Increased human activity associated with new access may affect big game distribution adjacent to new roads. Ward et al. (1980) found that elk prefer to stay over 0.1 mile from streams when crossing roads and that elk prefer to stay a minimum of 0.25 mile from traffic. A total of 7,264 acres of elk habitat would be lost if roads are constructed and remain open. Adverse impacts to big game habitat could be expected to effect 26,150 acres of habitat under this alternative (See Table IV-3, Appendix IV).

New access in the North Fork drainage would increase the estimated consumptive wildlife and fish user days to 2,500 and increase the estimated nonconsumptive wildlife and fish user days to 300.

The effect on threatened or endangered species (Colorado squawfish, bonytail chub and humpback chub) has been determined by the Forest Service as not significant (Appendix IV, Section 3, Revised Draft Appendix, "Biological Assessment"). Consultation with the U.S. Fish and Wildlife Service was completed on June 1, 1981. The U.S. Fish and Wildlife issued a "No Jeopardy" opinion (See Appendix I, pp. I-2-10).

This alternative has the potential to produce adverse impacts on 493 acres of "outstanding" scenic resources. Scenic value computation for this and other alternatives are in Appendix IV, Section 6, Revised Draft Appendix, "Landscape Management." The pipelines are designed to follow contours which reduce the nonmitigable vertical line impact. The visual impact would be more adverse during construction of the project than after completion when the landscape could return to its natural state to a limited extent.

There would be 532 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

There would be 29.6 miles of new access which would open up unroaded land in the West Branch and Roaring Fork area and could provide for eventual development of an east-west link between Battle Highway and Hog Park. Actual impacts are documented in Appendix IV, Section 7, Revised Draft Appendix, "Transportation".

This alternative would result in the inundation of numerous mining claims near Rob Roy Reservoir. The proponent will have to resolve this situation with affected claimants.

A cultural survey would be required on 2,675 acres to determine the existence of items of cultural or historical significance in accordance with Chapter 36, Code of Federal Regulations, Part 800. In addition, any artifacts uncovered during construction would require a work stoppage until investigations are complete. The project would comply with the National Historic Preservation Act of 1966 as implemented by the National Environmental Policy Act of 1969.

c. Socioeconomic Impacts

During construction, noise levels would increase with the operation of construction equipment. Equipment used would be of the same type as that used in highway earthwork operations. Most of the construction sites would be in remote and sparsely populated areas. Very few people living in the immediate area, traveling through the area, or camping in the area would be affected by construction noise. The construction phase would be temporary and the possible effects of noise are considered to be insignificant.

The proposed construction area would be located primarily on National Forest System land where habitation by people is nearly nonexistent. There are isolated cabins and some recreational use by the public in the western portion of the proposed construction area. The eastern portion is sparsely populated with ranching activity prevalent. The public may be inconvenienced by detour areas within the National Forest, however, they would be temporary. There would be no displacement of people during construction or after completion of the project.

The alternative would increase the water supply for Cheyenne. The population of Cheyenne and its immediate service area is projected to increase 70 percent from 1980 through 2000. The availability of water would enable the CBPU to meet future demands as a result of this population increase.

An estimated 150 construction workers would be working at one time in the Hog Park portion of the project. Hiring of both skilled and unskilled workers would probably be accomplished locally in the area of Rawlins, Encampment and Saratoga. Some may choose to commute from their present homes to the job site rather than live in the construction camp. Those workers brought to the job from outside of the immediate area may want to bring their families. They would require housing in any one of the communities in the surrounding area inclusive of Baggs, Dixon, Encampment, Riverside, Saratoga, and Rawlins. There is presently a housing shortage in all of these communities. Available rental units and mobile homes parks are filled to capacity.

The Rob Roy portion would be expected to have 100 construction workers on the job at any one time. They could be hired locally to the extent possible and commute from their homes to the job site. Those

hired from outside the area would require housing. It is expected that they will seek housing in Laramie. The city of Laramie experiences a shortage of rental units during the fall and winter months. One of the reasons for this is the housing required by students attending the University of Wyoming. During the summer months, a sufficient number of rental units are available. Housing may also be obtained by renting motel rooms in the area on a weekly or monthly contract basis.

Project implementation would cause disruption in the communities. Disruptions would be the movement of construction equipment and material through the communities en route to the job sites. This would be minimal and have a short-term effect.

The construction phase would bring more people into the nearby communities. This may necessitate the hiring of additional law enforcement officials to serve these communities. There should be no effect on existing fire protection by this population increase.

During the construction, communities surrounding the construction sites could benefit from sales tax which the construction workers and families would pay in the purchase of goods and services.

There would be no significant effect on property values within communities or on the land adjacent to the project. The Cheyenne area could realize an increase in property values as it becomes more attractive for development.

The communities in the western portion of the study area would realize an increase in enrollment at their schools by children of the construction workers residing there. The grade schools in the community of Rawlins are presently over capacity. A new elementary school is in the planning stage. Schools at Saratoga are also at capacity; however, the high school has satisfactory space. Schools in the community of Encampment are also crowded. Additional students enrolled in these school systems would create problems with classroom space.

The Little Snake River would experience the loss of the water that would be diverted to Cheyenne. This would affect the amount of available water currently being used for irrigation of farmland in the Little Snake River Valley, but would not affect senior water rights.

The proposed project would increase the water supply for Cheyenne which could allow for expansion of business and industry and for growth of the city. Increased growth of business and support facilities could shorten the time period that supplies would last. As growth increased due to available water, so could business needed to serve the new population which would tend to shorten the term of supply. In addition water supplies which would be in excess of Cheyenne's use during various growth periods is planned to be used by other communities along the North Platte River (Enrolled Act 43, Appendix IV, p. IV-125, Revised Draft Appendix). There could be questions as to what will happen if these communities grow and depend on this excess Stage II water for their own expanding population base. Would the community have to give this water back to Cheyenne as per Enrolled Act 43 and possibly suffer their own shortage, or would a legal issue ensue and laws change allowing these communities to retain the water for which they had established use thereby forcing Cheyenne to exist without additional Stage II water.

Although Stage III is designed to relieve this possibility there is no guarantee as to when or if Stage III would be implemented.

d. State and County Plans

There has been no identified conflict between the conditions of this alternative and goals found in the State, Albany County, and Carbon County Land Use Plans.

e. Public Issues

This alternative, with mitigation, has the potential to resolve most public issues. Questions have been raised in respect to providing water for downstrean users. Water permits have already been issued to Cheyenne for domestic water by the Wyoming State Engineer's Office.

3. Alternative C: MODIFY STAGE I COLLECTION SYSTEM TO INCREASE CAPACITY AND EXTEND THE PROPOSED SYSTEM TO THE VICINITY OF WEST BRANCH OF THE NORTH FORK OF THE LITTLE SNAKE RIVER.

a. Economics

Alternative C would increase the amount of water to Cheyenne by 15,800 acre-feet providing a total of

30,500 acre-feet from all sources. Based on 1980 costs the consumers would pay about $2.53 per 1,000 gallons or $858 per acre-foot for the first 250,000 gallons. Once a consumer exceeds 250,000 gallons they would pay $1.74 per 1,000 gallons or $592 per acre-foot. CBPU cost would be $1.26 per 1,000 gallons or $427 per acre-foot. The estimated cost to construct this option would be $83,346,000. Maintenance would cost approximately $114,500 annually to operate the facilities, maintain access roads, maintain pipelines, and treat water. This alternative would use approximately 14,700 kilowatt hours of electricity.

The Forest Service administrative costs during construction would be approximately $57,000. These costs would be for a project liaison officer and for a crew to mark timber for removal from the right-of-way and along the feathered clearing edge. Inspections of roads, pipelines, and collection structures would be conducted twice a year and cost $990 annually. Detailed inspection of the dams is required every five years and would be carried out by the Army Corps of Engineers. Annual inspections would be conducted by the permittee, or its representative, and the Forest Service.

The term of supply could vary from the year 2004 to beyond 2070 depending on the rate of consumption, conservation practices and rate of growth (See Graph II-1, p. 55). This term of supply could favorably be adjusted by using various conservation methods. Using less water could then result in a dollar savings to consumers. The city could also realize a savings by not having to process the extra amount.

b. Resource Management

The collection facilities in the Little Snake River drainage would be extended only to the West Branch and some of its tributaries. The Roaring Fork and its tributaries would not be diverted. The pipeline in the Little Snake drainage would end at Standard Creek. Water would not be collected in the Roaring Fork and Sherard Creek. Alternative C would result in diversion structures on seven fishery and 15 nonfishery streams in the Little Snake drainage. Development in the Douglas Creek drainage would include diversion structures on four fishery and 12 nonfishery streams. Rob Roy and Hog Park Reservoirs would be enlarged. Additional Stage II water would be released into Hog Park Creek and the Encampment

River on a modified release schedule to prevent channel damage and fish habitat loss. A pipeline would be required to transport water off National Forest land on Pole Mountain instead of allowing additional water to be released into Middle Crow Creek which would cause channel damage and fish habitat loss. The Stage I diversion structures in the North Fork of the Little Snake River drainage would be modified to increase the diversion efficiency of that system.

The average annual flow of the Little Snake River near Slater (the uppermost gage on the Little Snake River) would be decreased 9.9% by the 15,800 acre-feet/year Stage II diversion (See Table IV-1 in Appendix IV). Based on operation studies conducted by Banner Associates, Inc., (1981) for the 1940 to 1978 hydrologic period, the annual flow reductions would range between 7.5 and 13 percent at Slater with the highest depletion percentages occuring in dry years. For the Little Snake River near Dixon the average annual flow would be decreased 4.6 percent. On the Yampa River below the mouth of the Little Snake River, the annual flow reduction would only be 0.97 percent, which is less than the accuracy of streamflow measurements and would not be discernible.

The following is a breakdown of the 15,800 acre-feet average annual depletion by month expressed as a percent of Little Snake River average monthly flows near Slater and Dixon.

Stage II Depletions at Downstream Locations by Month

Month	Proportion of Flow Depleted 1/ by Alternative C (%)	
	Little Snake River near Slater	Little Snake River near Dixon
Nov	5.7	2.4
Dec	5.7	2.4
Jan	4.1	1.6
Feb	4.1	.8
Mar	3.2	.8
Apr	1.6	.8
May	10.5	4.9
Jun	14.6	8.1
Jul	2.4	2.4
Aug-Oct	0	0

1/ Table entries and percentages in text reduced from Alternative B by 19% to reflect less depletions (15,800 Acre-feet) in Alternative C.

For the Slater gage, these depletions would range from a high of 14.6 percent in June to none in August, September and October. Farther downstream at the Dixon gage, the percentage depletions would be about halved. The high proportion of depletions in May and June is not surprising since 94 percent of the Stage II water would be diverted during these two months.

There is more than sufficient water in the Little Snake River for municipal and agricultural uses diverting. The critical period is late summer and early fall when Little Snake flows decrease to almost nothing. Although Stage I flows have not been regulated by the Wyoming State Engineer, there is reason to believe that the much larger Stage II diversions would be regulated since streamflows during this period are not adequate to serve senior downstream water rights in most years. Such regulation could be anticipated in early July. Even if not regulated, minimum flow requirements (11 cfs) for aquatic life downstream from the diversion dams would normally lead to a shutdown in early August. If, as anticipated, the Stage II facilities are shut down in early July the significant effect would be to reach the shutdown date one to two days earlier.

Stage II development under Alternative C would increase salinity at downstream locations, but the impact would be relatively small. Salinity would be increased about 2.5 mg/l at Baggs and from 1.53 to 1.76 mg/l at downstream locations. (See Table IV-2, Appendix IV)

Erosion from the diversion dams, pipelines, and access roads construction will contribute to downstream turbidity. Baggs has experienced problems in the past with sediment clogging their infiltration gallery. The problem could be further aggravated under Alternative C.

The Forest Service's proposed payback schedule from Hog Park Reservoir would establish a 15 cfs minimum release and a 200 cfs peak release (See Appendix II, Section 14, Revised Draft Appendix). The minimum release would be about 11 cfs higher than natural flows in lower Hog Park Creek and about eight cfs higher than Stage I modified flows. The maximum release would be about 100 cfs greater than natural flows and about 55 cfs greater than Stage I modified flows. The higher peak flows would initially cause some bank erosion and flooding along lower Hog Park

Creek, as the scheduled releases in conjunction with natural attrition to streamflow downstream from the dam may in some locations exceed the 200 to 300 cfs channel capacity. From a fishery standpoint, the flow augmentation during low flows would more than offset any damages during high releases.

Along the Encampment River below Hog Park Creek, the proposed releases would as much as double natural streamflow during the nonsnowmelt period and result in up to about 25 percent increase during the snowmelt period. The increase in releases, particularly during the low flow periods, would be beneficial to the trout fishery, agriculture, and other uses of the Encampment River.

The principal impacts on hydrology of the Douglas Creek-Lake Creek area would be downstream from the Douglas Creek diversion dam. These impacts were assessed from operation studies conducted by Banner Associates, Inc. (1981) for the 1947 to 1971 hyrologic period. During the nonsnowmelt period, the impact would be mostly beneficial as the 5.5 cfs minimum release requirement downstream from the Douglas Creek diversion would in most years result in small to no reductions in flows from August to November and from 55 to 80 percent increase from December to March. In exceptionally dry years, the minimum release requirement would in worst cases result in triple the natural flows to the benefit of downstream aquatic life. The proposed 5.5 cfs minimum release compares with a Stage I minimum release of one cfs. At the Foxpark gaging station, located about ten miles downstream, the effects of operation of the Douglas Creek, Horse Creek, and Lake Creek diversion systems in most years would be essentially nil from August to November and increase streamflows 15 to 25 percent from December to March, again because of the 5.5 cfs minimum release requirement downstream from the Douglas Creek diversion. Essentially all diversions would occur from April to July resulting in a 55 to 95 percent flow reduction at the diversion dam in most years and up to 50 percent flow reduction at Foxpark after provision of minimum releases and flushing flows.

Most of the hydrologic impact to the North Platte would occur between the mouth of Douglas Creek and the mouth of the Encampment River where diverted Douglas Creek flows are replaced. Operation of the Douglas Creek diversion system would increase flows up to four percent during the nonsnowmelt season and reduce flows about 10 to 15 percent during the snowmelt period. The 14 adjudicated water rights

(through 1972) with accumulated diversion rights of 43.47 cfs would not be significantly affected by the Douglas Creek diversions.

Downstream from the mouth of the Encampment River, the annual payback schedule would have a stabilizing effect on flows of the North Platte River. Between October and early April in most years, the streamflow of the North Platte River at Saratoga would be increased five to ten percent while little change would occur in latter July, August, and September.

Flows would be reduced about two to four percent from late April to early July when large diversions of snowmelt runoff are made from the Douglas Creek system.

Maintenance flows would be provided in all Stage I and Stage II streams diverted in both the Little Snake and Douglas Creek drainages. This would include maintenance and flushing flows in all streams supporting fish populations and a blanket minimum flow in all nonfishery streams to maintain riparian habitat and seasonal reproductive use by trout populations. The flow below the Douglas Creek diversion structure would be increased from 1 cfs to 5.5 cfs.

Providing maintenance flows in Stage I streams would replace 252 Colorado River cutthroat trout habitat units in the North Fork of the Little Snake River drainage and 559 brook and brown trout habitat units in Douglas Creek which were lost due to inadequate stream flows.

The natural flow regime in Stage II streams would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur These include the total net loss of 39 Colorado River cutthroat trout habitat units in the Little Snake drainage. A net loss of 104 brook and brown trout habitat units would occur due to the inundation of 5.0 miles of trout stream above Hog Park Reservoir. There would be a loss of 280 brook and brown trout habitat units from the inundation of 3.9 miles of trout stream above Rob Roy Reservoir. A loss of 18 brook and brown trout habitat units would occur in Stage II streams in the Douglas Creek drainage.

Additional adverse impacts associated with construction and access which were not quantified in trout habitat units would occur with diversion of seven

Colorado River cutthroat trout streams in the Little Snake drainage and four brook and brown trout streams in the Douglas Creek drainage.

Hog Park Reservoir and Rob Roy Reservoir would be increased by 520 and 487 acres respectively. The dams would be increased in height by 50 feet. Geological technical surveys on both reservoir sites were conducted by Woodward and Clyde Engineering in 1979. Their findings revealed both sites suitable to support the increased size of the dams including the required stipulations on the design (Woodward and Clyde, 1979).

Currently Banner and Associates are completing an analysis of flood potential below the Hog Park and Rob Roy Reservoirs should a breach occur. Any questions regarding dam designs would be resolved between Banner Engineering and the Forest Service Engineers.

Reservoir enlargement could increase fish stocking needs. Flow enhancement in Hog Park Creek, the Encampment River and the South Fork of Middle Crow Creek would provide an estimated gain of 0, 224 and 239 habitat units respectively as mitigation. Fishery impacts are discussed further in Appendix IV, Section 2, Revised Draft Appendix, "Fisheries".

Turbidity would increase during construction but would not affect watersheds past the West Branch. Turbidity would not exceed state standards except under extreme climatic conditions. After five years, when vegetation on disturbed areas would become established, turbidity would return to current level. Salinity could increase between 1.53-1.76 mg/1 at Imperial Dam in Arizona. The current annual damage is $469,000. per mg (See Table III-7, p.120). For this alternative the total damage would range from $717,570 to $ 825,440. Salinity has decreased 100 mg. at Imperial Dam since 1973 (Salinity Control Forum, 1980, Draft #3, pg. 19). For more detailed analysis and complete data base see Appendix IV, Section 1, Revised Draft Appendix, "Watershed".

The enlargement of Rob Roy and Hog Park Reservoirs and the increase in access roads would alter the current recreation opportunity. There would be approximately 6,300 acres of land currently classed as semi-primitive motorized and nonmotorized dispersed recreation opportunities that would be accessed by highway type vehicles. See Appendix IV,

Section 8, Revised Draft Appendix, "Recreation and Wilderness."

Lakeview and Rob Roy campgrounds would have to be relocated at the expense of the proponent. There would be no adverse effect on capacities because they would be replaced by the same size facilities. The only change would be use patterns. The enlarged reservoirs could cause an administrative impact in terms of controls needed to keep use within limits of the carrying capacity.

There would be 3,780 acres of Area IV available to be recommended for wilderness as described in the Huston Park Land Management Plan. Flow regimes would be established to protect the Encampment and Platte River recommended wilderness areas. This alternative would leave 65,892 acres available for possible inclusion as wilderness.

This alternative would disturb soils on about 2,552 acres of forest land. These disturbances would include road construction, pipeline right-of-way clearing, and reservoir clearing associated with increased water levels. Borrow pits, spillway waste, and other waste disposal areas would be located within the areas to be inundated by the reservoirs. There would be 320 acres of land that would be very difficult to revegetate. Mass land failure potential amounts to 150 acres, The Soils data is in Appendix IV, Section 4, Revised Draft Appendix, "Soils".

This alternative would affect ranchers in the Hog Park and Rob Roy areas. It would also affect wildlife forage. The 935 acres lost by inundation would cause a reduction of 408 AUM's in grazing capacity for livestock and wildlife.

Wildlife habitat would be lost due to reservoir enlargement and road construction. Enlarging Hog Park Reservoir would inundate 157 acres of conifer forest, 283 acres of grass, and 8 acres of riparian habitat inundated. Enlarging Rob Roy would result in 280 acres of conifer forest, 27 acres of grass, and 180 acres of riparian habitat inundated. The construction of 15.8 miles of road from Rose Creek to the West Branch would remove 32.0 acres from production. Relocation of 3.0 miles of road around Hog Park Reservoir and 3.9 miles around Rob Roy Reservoir would result in a loss of 10.9 and 14.2 acres respectively. Other roads needed would follow the existing Stage I rights-of-way. Total habitat

loss with this alternative due to reservoir inundation and road construction would be 992 acres.

Riparian habitat loss would result from reservoir inundation and construction activities within riparian zones adjacent to streams proposed for diversion. Due to maintenance flow requirements, riparian habitat loss resulting from construction activities would be limited to the immediate construction zone.

This alternative would not result in a loss of any of the game or nongame species presently found within the project area. There would be no effect on the Encampment River big game winter range since construction would not occur in or near this area. Construction activities within the right-of-way across the Sheep Mountain big game winter range would be restricted to periods when this area is not used as winter range. Vegetation disturbance and loss in this area would be temporary as is evident from previous construction activities associated with Stage I across Sheep Mountain. Due to the location of construction activities, this alternative would not affect bighorn sheep, Columbian sharp-tailed grouse or sandhill cranes. Maintenance flow requirements will maintain habitat at existing levels for furbearers and waterfowl which may use some of the streams proposed for diversion.

Wildlife within or near the construction zone would relocate or be temporarily displaced during construction activities. Although new access roads would not restrict big game movement, elk and deer may adjust movement patterns across such roads. Increased human activity associated with new access may affect big game distribution adjacent to new roads. Ward et al., (1980) found that elk prefer to stay over 0.1 mile from streams when crossing roads and that elk prefer to stay a minimum of 0.25 mile from traffic. A total of 5,056 acres of elk habitat will be lost if proposed roads are constructed and remain open to public use, with adverse impacts anticipated on 18,202 acres (Table IV-3, Appendix IV).

New access in the North Fork drainage would increase the estimated consumptive wildlife and fish user days to 2,500 and increase the estimated nonconsumptive wildlife and fish user days to 300.

The effect on threatened or endangered species (Colorado squawfish, bonytail chub and humpback chub)

has been determined by the Forest Service as not significant (Appendix III, Section 3, Revised Draft Appendix, "Biological Assessment"). Formal consultation with the U.S. Fish and Wildlife Service was completed on June 1, 1981. The U.S. Fish and Wildlife Service issued a "No Jeopardy" opinion (See Appendix I, pp. I-2-10).

This alternative has the potential of producing an adverse impact on 493 acres of "outstanding" visual quality. The pipelines are designed to follow contours which reduce the nonmitigable vertical line impact. The visual impact would be more adverse during construction of the project than after completion, when the landscape could return to its natural state to a limited extent. Scenic value computations for this and other alternatives are found in Appendix IV, Section 6, Revised Draft Appendix, "Landscape Management."

There would be 450 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

The Hayden District transportation plan includes a new east-west route. Traffic use over the pipeline section could be limited since the road would dead end. Use beyond the West Branch would remain as foot travel or horseback. See Appendix IV, Section 7, Revised Draft Appendix, "Transportation."

This alternative would result in the inundation of numerous mining claims near Rob Roy Reservoir. The proponent will have to resolve this situation with affected claimants.

A cultural survey would be required on 2,552 acres to determine the existence of items of cultural or historical significance in accordance with Chapter 36, Code of Federal Regulations, Part 800. In addition, any artifacts uncovered during construction would require a work stoppage until investigations are complete. The project would comply with the National Historic Preservation Act of 1966 as implemented by the National Environmental Policy Act.

c. Socioeconomic Impacts

During construction, noise levels would increase with the operation of construction equipment. Equipment used would be of the same type as that used in highway earthwork operations. Most of the construction sites would be in remote and sparsely populated areas. Very few people living in the

immediate area, traveling through the area, or camping in the area would be affected by construction noise. The construction phase would be temporary and the possible effects of noise are considered to be insignificant.

The proposed construction area would be located mostly on National Forest System lands where habitation by people is nearly nonexistent. There are isolated cabins and some recreational use by the public in the western portion of the proposed construction area. The eastern portion is sparsely populated with ranching activity prevalent. The public may be inconvenienced by detour areas within the National Forest, however, they would be temporary. There would be no displacement of people during construction or after completion of the project.

The alternative would increase the water supply for Cheyenne. The populations of Cheyenne and its immediate service area is projected to increase 70 percent from 1980 through 2000. The availability of water would enable CBPU to meet future demands as a result of this population increase.

An estimated 150 construction workers would be working at one time in the Hog Park portion of the project. Hiring of both skilled and unskilled workers would probably be accomplished locally in the area of Rawlins, Encampment and Saratoga. Some may choose to commute from their present homes to the job site rather than live in the construction camp. Those workers brought to the job from outside of the immediate area may want to bring their families. They would require housing in any one of the communities in the surrounding area inclusive of Baggs, Dixon, Encampment, Riverside, Saratoga, and Rawlins. There is presently a housing shortage in all of these communities. Available rental units and mobile homes parks are filled to capacity.

The Rob Roy portion would be expected to have 100 construction workers on the job at any one time. They could be hired locally to the extent possible and commute from their homes to the job site. Those hired from outside the area would require housing. It is expected that they will seek housing in Laramie. The city of Laramie experiences a shortage of rental units during the fall and winter months. One of the reasons for this is the housing required by students attending the University of Wyoming. During the summer months, a sufficient number of rental units

are available. Housing may also be obtained by renting motel rooms in the area on a weekly or monthly basis.

Project implementation would cause disruption in the communities. Disruptions would be the movement of construction equipment and material through the communities en route to the job sites. This would be minimal and have a short-term effect.

The construction phase would bring more people into the nearby communities. This may necessitate the hiring of additional law enforcement officials to serve these communities. There should be no effect on existing fire protection by this population increase.

During the construction, communities surrounding the construction sites could benefit from sales tax which the construction workers and families would pay in the purchase of goods and services.

There would be no significant effect on property values within communities or on the land adjacent to the project. The Cheyenne area could realize an increase in property values as it becomes more attractive for development.

The communities in the western portion of the study area would realize an increase in enrollment at their schools by children of the construction workers residing there. The grade schools in the community of Rawlins are presently over capacity. A new elementary school is in the planning stage. Schools at Saratoga are also at capacity; however, the high school has satisfactory space. Schools in the community of Encampment are also crowded. Additional students enrolled in these school systems would create problems with classroom space.

The Little Snake River would experience the loss of the water that would be diverted to Cheyenne. This would affect the amount of available water currently being used for irrigation of farmland in the Little Snake River Valley, but would not affect senior water rights.

This alternative would increase the water supply for the City of Cheyenne which could allow for expansion of business and industry and for growth of the city. Increased growth of business and support facilities could shorten the time period that supplies would last. As growth increased due to available water,

so could business needed to serve the new population which would tend to shorten the term of supply. In addition water supplies which would be in excess of Cheyenne's use during various growth periods is planned to be used by other communities along the North Platte River (Enrolled Act 43, Appendix IV, p. IV-125, Revised Draft Appendix). There could be questions as to what will happen if these communities grow and depend on this excess Stage II water for their own expanding population base. Would the community have to give this water back to Cheyenne as per Enrolled Act 43 and possibly suffer their own shortage, or would a legal issue ensue and laws change allowing these communities to retain the water for which they had established use thereby forcing Cheyenne to exist without additional Stage II water.

Although Stage III is designed to relieve this possibility there is no guarantee as to when or if Stage III would be implemented.

d. <u>State and County Plans</u>

The State, Carbon County, and Albany County Land Use Plans were consulted. The increase in the amount of delivered water will meet only 80% of the water goals.

e. <u>Public Issues</u>

This alternative, with mitigation, has potential to resolve most public issues. Access into unroaded areas would be limited to 4.5 miles. Issues of impact on downstream users have been considered but would have to be resolved outside of the analysis described in this document since it is the responsibility of the Wyoming State Engineer to regulate permitted water uses.

4. <u>Alternative D</u>: CONSTRUCT A LOWER RESERVOIR IN THE NORTH OR MIDDLE FORK OF LITTLE SNAKE RIVER AND PUMP TO HOG PARK RESERVOIR

a. <u>Economics</u>

Alternative D would increase the amount of water to Cheyenne by 18,000 acre-feet, providing a total of 32,700 acre-feet from all sources. The costs to the consumer based on 1980 dollars, would be $4.38 per 1,000 gallons or $1,429 per acre-foot for the first 250,000 gallons. Once a consumer exceeds 250,000 gallons they would pay $3.01 per 1,000 gallons or

$981 per acre-foot. Production costs to the CBPU would be $2.18 per 1,000 gallons or $711 per acre-foot. Construction cost is estimated to be $138,543,000. It would cost approximately $2,405,000 annually to maintain these facilities. In addition, about $2,348,000 would be expended for electrical power to operate the pumping system which would require approximately 33,320,000 kilowatt hours of electricity annually.

Forest Service administrative costs during construction would be approximately $37,200. Administration of occupancy documents would include inspecting roads, pipelines, and collection structures twice a year at an approximate cost of $774. Detailed inspections of dams are required every five years and would be carried out by the Army Corps of Engineers. Annual inspections would be conducted by the permittee or its representative and the Forest Service.

The term of supply could vary from year 2008 to beyond 2070 depending on the rate of consumption, conservation practices and rate of growth (See Graph II-1, pg. 55). This term of supply could be favorably adjusted by using various water conservation methods. Using less water could then result in a dollar savings to consumers. The city could also realize a savings by not having to process the extra amount.

b. Resource Management

This alternative would place no gravity flow collection system in the Little Snake drainage. Fish populations, movements, and habitats in the upper Little Snake tributaries would not be affected. Maintenance flows would be provided in all Stage I and Stage II streams diverted in both the Little Snake and Douglas Creek drainages. This would include maintenance and flushing flows in all streams supporting fish populations and a blanket minimum flow in all nonfishery streams to maintain riparian habitat and seasonal reproductive use by trout populations. The flow below the Douglas Creek diversion structure would be increased from 1 cfs to 5.5 cfs.

The average annual flow of the Little Snake River near Slater (the uppermost gage on the Little Snake River) would be decreased 11.0 percent by the 18,000 acre-feet/year stored in the lower reservoir. (See

Table IV-1, Appendix IV). Based on operation studies conducted by Banner Associates, Inc., (1981) for the 1940 to 1978 hydrologic period, the annual flow reductions would range between 8.3 and 14.7 percent at Slater with the highest depletion percentages occurring in dry years. For the Little Snake River near Dixon the average annual flow would be decreased 5.2 percent. On the Yampa River below the mouth of the Little Snake River, the annual flow reduction would only be 1.1 percent, which is less than the accuracy of streamflow measurements and would not be discernible.

The principal hydrologic advantage of Alternative D would be to replace the large number of diversions at the head ends of the North Fork, West Branch North Fork, and Roaring Fork drainages with one much larger diversion at the proposed reservoir location. The larger drainage area contributing runoff would result in a more dependable yield and a much smaller proportion of annual flow removal.

The following is a breakdown of the 18,000 acre-feet average annual depletion by month expressed as a percent of Little Snake River average monthly flows near Slater and Dixon.

Stage II Depletions at Downstream Locations by Month

Month	Proportion of Flow Depleted by Alternative D (%)	
	Little Snake River near Slater	Little Snake River near Dixon
Nov	6.4	2.8
Dec	6.4	2.8
Jan	4.6	1.8
Feb	4.6	.9
Mar	3.7	.9
Apr	1.8	.9
May	12.0	5.5
Jun	16.6	9.2
Jul	2.8	2.8
Aug-Oct	0	0

For the Slater gage, these depletions would range from a high of 16.6 percent in June to none in August, September, and October. Farther downstream at the Dixon gage, the percentage depletions would be about balved. The high proportion of depletions in May and June is not surprising since 94 percent of the Stage II water would be stored during these two months.

There is more than sufficient water in the Little Snake River for municipal and agricultural uses during the months when Stage II would be actively storing. The critical period is late summer and early fall when Little Snake River flows decrease to almost nothing. Although Stage I flows have not been regulated by the Wyoming State Engineer, there is reason to believe that Stage II storage would be regulated since streamflows during this period are not adequate to serve senior downstream water rights in most years. Such regulation would be anticipated to require storage release or bypass in early July.

Stage II development under Alternative D would increase salinity at downstream locations, but the impact would be relatively small. Salinity would be increased about 2.8 mg/l at Baggs and from 1.69 to 1.94 at downstream locations. (See Table IV-2, Appendix IV).

Alternative D also offers the potential to benefit downstream water users in the Little Snake River basin by building the reservoir larger to store snowmelt runoff excess to Cheyenne's needs. This excess stored water could then be released during the irrigation season. However, this would involve additional costs which have not been included here.

The reservoir would trap sediments produced in the upstream watershed as a result of erosion from the Stage I area or as a result of other causes. The community of Bagg's problem with clogging of its infiltration gallery would be partially alleviated.

The Forest Service's proposed payback schedule from Hog Park Reservoir would remain in current status since there would be no additional water. The minimum release would be about 11 cfs higher than natural flows in lower Hog Park Creek and about eight cfs higher than Stage I modified flows. The maximum release would be about 100 cfs greater than natural flows and about 55 cfs greater than Stage I modified flows. The higher peak flows would initially cause some bank erosion and flooding along lower Hog Park Creek, as the scheduled releases in conjunction with natural attrition to streamflow downstream from the dam may, in some locations, exceed the 200 to 300 cfs channel capacity. From a fishery standpoint, the flow augmentation during low flows would more than offset any damages during high releases.

Along the Encampment River below Hog Park Creek, the proposed releases would as much as double natural streamflow during the nonsnowmelt period and result

in up to about 25 percent increase during the snowmelt period. The increase in releases, particularly during the low flow periods, would be beneficial to the trout fishery, agriculture, and other uses of the Encampment River.

The principal impacts on hydrology of the Douglas Creek-Lake area would be downstream from the Douglas Creek diversion dam. These impacts were assessed from operation studies conducted by Banner Associates, Inc. (1981) for the 1947 to 1971 hydrologic period. During the nonsnowmelt period, the impact would be mostly beneficial as the 5.5 cfs minimum release requirement downstream from the Douglas Creek diversion would in most years result in small to no reductions in flows from August to November and from 55 to 80 percent increase from December to March. In exceptionally dry years, the minimum release requirement would in worst cases result in triple the natural flows to the benefit of downstream aquatic life. The proposed 5.5 cfs minimum release compares with a Stage I minimum release of one cfs. At the Foxpark gaging station located about 10 miles downstream, the effects of operation of the Douglas Creek, Horse Creek, and Lake Creek diversion systems in most years would be essentially nil from August to November and increase streamflows 15 to 25 percent from December to March, again because of the 5.5 cfs minimum release requirement downstream from the Douglas Creek diversion. Essentially all diversions would occur from April to July resulting in a 55 to 95 percent flow reduction at the diversion dam in most years and up to 50 percent flow reduction at Foxpark after provision of minimum releases and flushing flows.

Most of the hydrologic impact to the North Platte would occur between the mouth of Douglas Creek and the mouth of the Encampment River where diverted Douglas Creek flows are replaced. Operation of the Douglas Creek diversion system would increase flows up to four percent during the nonsnowmelt season and reduce flows about ten to fifteen percent during the snowmelt period. The 14 adjudicated water rights (through 1972) with accumulated diversion rights of 43.47 cfs would not be significantly affected by the Douglas Creek diversions.

Downstream from the mouth of the Encampment River, the annual payback schedule would have a stabilizing effect on flows of the North Platte River. Between October and early April in most years, the streamflow of the North Platte River at Saratoga would be

increased five to ten percent while little change would occur in latter July, August, and September. Flows would be reduced about two to four percent from late April to early July when large diversions of snowmelt runoff are made from the Douglas Creek system.

Providing maintenance flows in Stage I streams would replace 252 Colorado River cutthroat trout habitat units in the North Fork of the Little Snake River drainage and 559 brook and brown trout habitat units in Douglas Creek which were lost due to inadequate stream flows. The table, Summary of Environmental Impacts, graphically display the net effects this action alternative with mitigation would have on trout habitat units.

The natural flow regime in Stage II streams in the Douglas Creek drainage would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur. These include a total net loss of 18 Colorado River cutthroat trout habitat units and a loss of 18 brook and brown trout habitat units in the Douglas Creek drainage. A net loss of 121 brook and brown trout habitat units would occur due to inundation of 5.8 miles of trout stream above Hog Park Reservoir. There would also be a loss of 280 brook and brown trout habitat units as a result of inundation of 3.9 miles of trout stream above Rob Roy Reservoir.

Populations of Colorado River cutthroat trout, which are located above the fish barrier installed by the Wyoming Game and Fish Department, may be affected by reservoir construction. Building a lower reservoir in the Little Snake drainage would result in a loss of 683 brook, brown, and rainbow trout habitat units due to the inundation of 4.9 miles of stream.

Additional adverse impacts associated with construction which were not quantified in trout habitat units would occur with diversion of four brook and brown trout streams in the Douglas Creek drainage.

Hog Park Reservoir and Rob Roy Reservoir would be increased by 520 and 487 acres respectively. The dams would be increased in height by 50 feet. Geological technical surveys on both reservoir sites were conducted by Woodward and Clyde Engineering in 1979. Their findings revealed both sites suitable to support the increased size of the dams including the required stipulations on the design (Woodward and Clyde, 1979).

Currently Banner and Associates are completing an analysis of flood potential below the Hog Park and Rob Roy Reservoirs should a breach occur. Any questions regarding dam designs would be resolved between Banner Engineering and the Forest Service Engineers.

Reservoir enlargement could increase fish stocking needs. A lower reservoir constructed in the Little Snake drainage would provide 400 acres of reservoir which would also require stocking. Flow enhancement in Hog Park Creek, the Encampment River, and the South Fork of Middle Crow Creek would provide an estimated gain of 0, 224 and 239 habitat units respectively as mitigation. Fishery impacts are discussed further in Appendix IV, Section 2, Revised Draft Appendix, "Fisheries".

Turbidity would not exceed state standards except under extreme climatic conditions. The long term effect would return the turbidity to current conditions after the establishment of soil holding vegetation. The collection of the 33,000 acre-feet of water in the reservoir could increase the salinity between 1.89-2.17 milligrams of solids per liter of water measured at Imperial Dam in Arizona. The current annual damage is $469,000. per mg. (See Table III-7, p.120). For this alternative the damage range would be from $886,410. to $1,017,730 at Imperial Dam. The salinity has decreased at Imperial Dam by 100 mg. since 1973 (Salinity Control Forum, 1980, p. 19).

For a more complete analysis and data base see Appendix IV, Section 1, Revised Draft Appendix, "Watershed".

Recreation opportunities would remain semi-primitive, nonmotorized, and motorized with the exception of 2,700 acres converted to roaded natural or rural use resulting from improved road access between the Little Snake Reservoir and Hog Park. See Appendix III, Section 8, Revised Draft Appendix, "Recreation and Wilderness."

Enlarging Hog Park and Rob Roy Reservoirs could change recreation activities. Developed recreation and travel increases would produce additional recreation administrative impacts. There would be an additional recreation impact on the new lower reservoir. There is no current funding to provide facilities for this area. Opportunities would increase for the recreation visitor interested in water associated activites. The 5,210 acres in Area IV of

Huston Park would be available for recommendation as wilderness. There would be a total of 67,322 acres available for possible inclusion as wilderness.

This alternative would disturb soils on 3,079 acres with 500 acres of very low revegetation potential lands involved. Borrow and waste areas would be contained within the inundation area of Hog Park and Rob Roy Reservoirs. An off-site borrow area for the Little Snake Reservoir would have to be established. There would be 740 acres susceptible to mass land failure, but improvements would be routed around these areas.

This alternative would affect ranchers in the Hog Park and Rob Roy areas. It would also affect wildlife forage. This alternative would cause a reduction of 455 AUM's in grazing capacity for livestock and wildlife.

Wildlife habitat would be lost due to reservoir enlargement, new reservoir establishment and road construction. The new reservoir in the lower North Fork drainage would inundate 260 acres of conifer, 135 acres of grass and sagebrush and five acres of riparian habitat. Enlarging of Hog Park Reservoir would inundate 182 acres of conifer, 328 acres of grass and 10 acres of riparian habitat. Enlarging Rob Roy would result in 280 acres of conifer, 27 acres of grass and 180 acres of riparian habitat inundated. The 8.8 mile road from the tunnel to the new reservoir site would take 17.1 acres out of production. Relocation of 3.0 miles of road around Hog Park Reservoir and 3.9 miles around Rob Roy Reservoir would result in a loss of 10.9 and 14.2 acres respectively. The 6.6 miles of new road in the Lake Creek drainage would be temporary road because adequate access roads already exist. Other roads needed would follow the existing Stage I right-of-ways. Total habitat loss with this alternative due to reservoir inundation and road construction would be 1,449.

Riparian habitat loss would result from reservoir inundation and construction activities within riparian zones adjacent to streams proposed for diversion. Due to maintenance flow requirements, reparian habitat loss resulting from construction activities would be limited to the immediate construction zone.

This alternative would not result in a loss of any of the game or nongame species presently found within the proposed project area. There would be no effect on the Encampment River big game winter range since construction will not occur in or near this area. Construction activities within the right-of-way across the Sheep Mountain big game winter range would be restricted to periods when this area is not used as winter range. Vegetation disturbance and loss in this area would be temporary. This is evident from previous construction activities associated with Stage I across Sheep Mountain. Due to the location of construction activities this alternative would not affect bighorn sheep. Columbian sharp-tailed grouse and sandhill crane habitat would be inundated by the lower reservoir in the North Fork drainage. Maintenance flow requirements will maintain habitat at existing levels for furbearers and waterfowl which may use some of the streams proposed for diversion.

Wildlife within or near the construction zone would relocate or be temporarily displaced during construction activities. Since the lower reservoir would be approximately four miles long, wildlife movement patterns across the North Fork drainage in this stream section would ae effected. Although new access roads would not restrict big game movement, elk and deer may adjust movement patterns across such roads. Increased human activity associated with new access may affect big game distribution adjacent to new roads. Ward et al. (1980) found that elk prefer to stay over 0.1 mile from streams when crossing roads and that elk prefer to stay a minimum of 0.25 mile from traffic. A total of 2,816 acres of elk habitat would be lost if roads are constructed and remain open. Adverse impacts to big game habitat are expected to effect 10,138 acres of habitat under this alternative (See Table IV-3 Appendix IV).

Since new access would not be provided in the Sierra Madre area, the number of consumptive and nonconsumptive wildlife and fish user days which are presently estimated at 1,100 and 100 would not be affected.

The effect on threatened or endangered fish species (Colorado squawfish, bonytail chub and humpback chub) has been determined by the Forest Service as not significant (Appendix III, Section 3, "Biological Assessment"). Consultation with the U.S. Fish and Wildlife

Service was completed on June 1, 1981. The U.S. Fish and Wildlife Service issued a "No Jeopardy" opinion (See Appendix I, pp. I-2-10).

The current visual quality would not be altered in the outstanding area between West Branch and Deadline Creek. The 443 acre outstanding area at Hog Park, would be altered somewhat by raising the water level. The outstanding qualities of the flat mirror reflecting plane of the water would still exist but the meadow-conifer contrast would not be present. See Appendix, IV, Section 6, Revised Draft Appendix, "Landscape Management".

There would be 764 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

Road and trail systems would be maintained as is with an anticipated 15.7 miles of new access needed to serve the pipeline system and reservoir areas.

Recreation travel to Hog Park and Rob Roy would increase as both reservoirs would be larger (Appendix IV, Section 7, Revised Draft Appendix, "Transportation"). The transportation system would forego the opportunity to connect Battle Highway and Hog Park.

This alternative would result in the inundation of numerous mining claims near Rob Roy Reservoir. The proponent will have to resolve this situation with affected claimants.

A cultural survey would be required on 3,079 acres to determine the existence of items of cultural or historical significance in accordance with Chapter 36, Code of Federal Regulations, Part 800. In addition, any artifacts uncovered during construction would require work stoppage until investigations are complete. The project would comply with the National Historic Preservation Act of 1966 as implemented by the National Environmental Policy Act.

c. Socioeconomic Impacts

During construction, noise levels would increase with the operation of construction equipment. Equipment used would be of the same type as that used in highway earthwork operations. Most of the construction sites would be in remote and sparsely populated areas.

Very few people living in the immediate area, traveling through the area, or camping in the area would be affected by construction noise. The construction phase of the proposal would be temporary and the possible effects of noise are considered to be insignificant.

The proposed construction area would be located mostly on National Forest System lands where habitation by people is nearly nonexistent. There are isolated cabins and some recreational use by the public in the western portion of the proposed construction area. The eastern portion is sparsely populated with ranching activity prevalent. The public may be inconvenienced by detour areas within the National Forest; however, they would be temporary. There would be no displacement of people during construction or after completion of the project.

The alternative would increase the water supply for Cheyenne. The population of Cheyenne and its immediate service area is projected to increase 70 percent from 1980 through 2000. The availability of water would enable the CBPU to meet future demands as a result of this population increase.

An estimated 150 construction workers would be working at one time in the Hog Park portion of the project. Hiring of both skilled and unskilled workers would probably be accomplished locally in the area of Rawlins, Encampment and Saratoga. Some may choose to commute from their present homes to the job site rather than live in the construction camp. Those workers brought to the job from outside of the immediate area may want to bring their families. They would require housing in any one of the communities in the surrounding area inclusive of Baggs, Dixon, Encampment, Riverside, Saratoga, and Rawlins. There is presently a housing shortage in all of these communities. Available rental units and mobile homes parks are filled to capacity.

The Rob Roy portion would be expected to have 100 construction workers on the job at any one time. They could be hired locally to the extent possible and commute from their homes to the job site. Those hired from outside the area would require housing. It is expected that they will seek housing in Laramie.

The city of Laramie experiences a shortage of rental units during the fall and winter months. One of reasons for this is the housing required by students attending the University of Wyoming. During the summer months, a sufficient number of rental units are available. Housing may also be obtained by renting motel rooms in the area on a weekly or monthly contract basis.

A total of 50 construction workers would be required at the proposed reservoir site on the Little Snake River.

Project implementation would cause disruption in the communities. Disruptions would be the movement of construction equipment and material through the communities in route to the job sites. This would be minimal and have a short-term effect.

The construction phase would bring more people into the nearby communities. This may necessitate the hiring of additional law enforcement officials to serve these communities. There should be no effect on existing fire protection by this population increase.

During the construction, communities surrounding the construction sites could benefit from sales tax which the construction workers and families would pay in the purchase of goods and services.

There would be no significant effect on property values within communities or on the land adjacent to the project. The Cheyenne area could realize an increase in property values as it becomes more attractive for development.

The communities in the western portion of the study area would realize an increase in enrollment at their schools by children of the construction workers residing there. The grade schools in the community of Rawlins are presently over capacity. A new elementary school is in the planning stage. Schools at Saratoga are also at capacity; however, the high school has satisfactory space. Schools in the community of Encampment are also crowded. Additional students enrolled in these school systems would create problems with classroom space.

The Little Snake River would experience the loss of the water that would be diverted to Cheyenne. This would affect the amount of available water currently

being used for irrigation of farmland in the Little Snake River Valley, but would not affect senior water rights.

This alternative would increase the water supply for the city of Cheyenne which could allow for expansion of business and industry and for growth of the city. Increased growth of business and support facilities could shorten the time period that supplies would last. As growth increased due to available water, so could business needed to serve the new population which would tend to shorten the term of supply. In addition water supplies which would be in excess of Cheyenne's use during various growth periods is planned to be used by other communities along the North Platte River (Enrolled Act 43, Appendix IV, pg. IV-125, Revised Draft Appendix). There could be question as to what will happen if these communities grow and depend on this excess Stage II water for their own expanding population base. Would the community have to give this water back to Cheyenne as per Enrolled Act 43 and possibly suffer their own shortage, or would a legal issue ensue and laws change allowing these communities to retain the water for which they had established use thereby forcing Cheyenne to exist without additional Stage II water.

Although Stage III is designed to relieve this possibility there is no guarantee as to when or if Stage III would be implemented.

d. State and County Plans

The Wyoming, Carbon County, and Albany County Land Use Plans were reviewed and no conflicts with the goals were identified.

e. Public Issues

This alternative would have the potential to resolve most public issues. It would eliminate the need for diversion structures in Stage II streams which contain Colorado River cutthroat trout. The unroaded areas would remain in their current status. Effects on downstream users on the lower North Fork would remain in the current status.

4. Alternative E: COMBINE WATER CONSERVATION, AGRICULTURE WATER RIGHT PURCHASE AND GROUNDWATER DEVELOPMENT

a. Economics

Alternative E would increase the amount of water to Cheyenne by 13,000 acre-feet. With all costs based on 1980 dollars, the cost to the consumer would be $2.33 per 1,000 gallons or $788 per acre-foot for the first 250,000 gallons. Once a consumer exceeds 250,000 gallons, they would pay $1.61 per 1,000 gallons or $543 per acre-foot. The CBPU cost would be $1.16 per 1,000 gallons or $392 per acre-foot. The cost to construct this system is estimated at $53,453,000.

It would cost approximately $1,102,200 annually to maintain diversion structures, roads, pipelines, operate flow releases, pump and treat water. Annual energy consumption has been calculated at 5,514,400 kilowatt hours.

Forest Service administrative costs during construction would be approximately $15,000. These costs would include a project liaison officer and a crew to mark timber for removal from the right-of-way and along the feathered edges between the Lake Creek collection area and Lake Owen.

Administration of occupancy documents would consist of inspecting pipelines and collection structures in the Douglas Creek-Lake Creek area twice a year, plus Stage I facilities. This would cost $700 annually. These inspections would include the Forest Service, the permittee or its representative and necessary representatives from affected Wyoming regulatory agencies.

The term of supply could vary from 2000 to beyond 2070 depending on the rate of consumption, conservation practices and growth rate (See Graph II-1, p. 55). The data base for economic feasibility is in Appendix IV p. IV-6.

b. Resource Management

Facility development would be limited to the Douglas Creek, Lake Creek, Lake Owen and Pole Mountain areas. There would be a pipeline extending from Douglas Creek to Pole Mountain as described in Chapter II, Section IV. This pipeline would be required to transfer water off of Pole Mountain instead of allowing additional water to flow down Middle Crow Creek. Diversion structures would be placed on eight streams in the Lake Creek System. This water would flow to Lake Owen and onto Pole Mountain. There would be maintenance and flushing flows in these streams to maintain fish and riparian habitats.

There would be no modification of the Stage I system, and the maintenance flows required by other alternatives in these streams would not be present. Those streams which are dry in the Sierra Madre area would remain so and Douglas Creek would continue to have only one cfs of flow immediately downstream from the diversion structure.

By not providing for the Stage I flows the 252 Colorado River cutthroat trout habitat units in the North Fork of the Little Snake River drainage and the 559 brook and brown trout habitat units in the Douglas Creek drainage would not be reclaimed. The table at the end of this chapter, summarizing Environmental Impacts, graphically displays the net effects this action alternative with mitigation would have on trout habitat units. 1/

With this alternative the only development on National Forest Land would be the Lake Creek diversion pipeline and an additional pipeline from the Douglas Creek diversion to Lake Owen and from Lake Owen to Pole Mountain. Rob Roy Reservoir would not be enlarged and there would be no development in the Sierra Madre Mountains, therefore additional instream flows would not be returned to Stage I streams. Maintenance and flushing flows would be required in Lake Creek, Camp Creek, Little Beaver Creek and Nugget Gulch Creek in the Lake Creek and Douglas Creek drainages. The resulting trout habitat unit loss would be 18 units.

Turbidity during and after the construction period would not exceed state standards except under extreme climatic conditions. There would be no changes in salinity concentrations of the Colorado River System as a result of this alternative action since no additional development in the Little Snake Drainage would occur. Rob Roy and Lake View Campgrounds would remain intact and not require replacement. Recreation use impacts resulting from increased reservoir size would not occur.

1/ A trout habitat unit is defined as the amount of habitat quality required to produce an increase in trout standing crop of one pound per surface acre (Binns, 1976).

The 11.9 miles of road involved in the Lake Creek drainage would be temporary, and no development is planned, therefore the dispersed recreation opportunities would not change. They would be identical to those specified for Alternative A. The 5,210 acre Area IV described in the Huston Park Land Management Plan would be available to be recommended for wilderness inclusion along with Area I immediately to the North.

This alternative would disturb soils on approximately 340 acres of National Forest Land. There would be no additional wildlife benefits or losses. Wildlife habitat would not be inundated by reservoir enlargement or establishment. Consumptive and nonconsumptive wildlife and fish user days are presently estimated at 1,100 and 100 days in the proposal area west of the Continental Divide and would not be affected. Alternative would not result in any loss of AUM's for either wildlife or domestic stock.

Wildlife habitat impacts would be limited to temporary displacement during the period when an additional pipeline is placed along the existing right-of-way from Douglas creek to Lake Owen to Pole Mountain, and also during the time when the Lake Creek Road and pipeline are built. The 6.6 miles of new road in the Lake Creek drainage would be temporary road because adequate access roads already exist.

The transportation system linking the affected areas would not change. There would be no increased maintenance costs to the counties or the Forest Service. There would be 110 acres of tree cover eliminated by roads and pipelines.

There would be no need to relocate the 6.9 miles of road around Rob Roy and Hog Park Reservoirs including the Lakeview and Rob Roy Campgrounds. Current road and trail use patterns would not be affected and few increased demands would be put on the system.

A cultural survey would be required on 340 acres to determine the existence of items of cultural or historical significance in accordance with Chapter 36, Code of Federal Regulations, Part 800. In addition, any artifacts uncovered during construction would require a work stoppage until investigations are complete. The project would comply with the National Historic Preservation Act of 1966 as implemented by the National Environmental Policy Act of 1969.

c. Socioeconomic Impacts

The proposed construction sites, with the exception of the section between Rob Roy Reservoir and Pole Mountain, would be left undisturbed. Therefore, there would be little change to existing noise levels.

Population growth would most likely continue in the Cheyenne service area. Water usage would not be limited under this alternative. Cheyenne's ability to meet future water demand as influenced by its population growth will rely on availability of water rights, groundwater and conservation initiative. In addition to the population served and the increase in growth rates, there are other variables which will influence demand in the future. These include climatic changes, the cost of water and its rate structure, per capita income, and voluntary water conservation.

There is the possibility that new industry would develop in Cheyenne and this may result in an increase in industrial water demand. New industry would probably result in an increase of families moving into the Cheyenne service area. This would bring about an increase in water demand for nonindustrial use. The CBPU could meet these future water demands with alternative E.

The total construction force would be limited to approximately 50 at one time for the installation of pipe. The anticipated problems with housing shortages, construction camps on National Forest land and increased traffic would not occur. The impact on Laramie would be minor since most workers could commute on a daily basis and, for the most part, the construction season would be outside of the University of Wyoming school year. There would be fewer <u>outside</u> goods and services purchased in local communities by a large outside work force.

There would be no significant effect on property values within communities or on the land adjacent to the project. The Cheyenne area could realize an increase in property values as it becomes more attractive for development.

Increased growth of business and support facilities would shorten the time period that supplies would last. As growth increased due to available water, so could business needed to serve the new population which would tend to shorten the term of supply. In addition water supplies in excess of Cheyenne's use during various growth periods may be used by other communities along the North Platte

River (Enrolled Act 43, Appendix IV, Revised Draft Appendix, p. IV-125). In all probability, this excess water would not be available under this alternative. Communties depending on this supply could suffer their own shortage.

Although Stage III is designed to relieve this possibility there is no guarantee as to when or if Stage III would be implemented.

There would be a $304,405. annual loss in agricultural production as a result of removing water from irrigation. These losses are discussed in Chapter II, beginning with Section C, Part 3.

d. State and County Plans

This area would affect state and county land plans in the areas of agricultural production, agricultural land use, and water management development options for others using either agricultural water or groundwater in the proposed development sectors.

e. Public Issues

This option would favorably address public issues except for increasing flows to Stage I streams, developing compact allocated water, and providing water supplies to other communities. The role of water conservation plays an important part in this alternative. Agricultural water rights and groundwater would be used which could create additional issues of maintaining specific life-styles on a statewide basis. The remaining identified issues result from adverse impacts resulting from potential full development of the original plan and are thereby resolved by this alternative.

C. SHORT TERM USE AND LONG TERM PRODUCTIVITY

Short term uses are those which generally occur yearly. There are no short term uses associated with any of the action alternative. Long term productivity deals with time spans of 50 years or more. The proposed action and alternatives B, C, D, and E would be long term uses. The mitigating measures and monitoring requirements listed in Chapter II are included to ensure that long term productivity of the affected resources is maintained to the largest extent possible. Alternative A would not vary the existing condition. The Stage I system would continue to be a long term use, and productivity would remain the same.

The overall long term productivity was adversely affected by the unmitigated effects of Stage I. The long term productivity could be enhanced as Stage II mitigation measures require a continuous flow be put back into those streams would be diverted by Stage I.

Depending on the rate of consumption, the use described in this EIS could extend well past the year 2070 (Chapter II, pp. 49-55). The current short term uses within the affected environment have had their adverse impacts mitigated except to the extent discussed in Section E of this chapter.

D. IRREVERSIBLE AND IRRETRIEVABLE COMMITTMENT OF RESOURCES

Irreversible commitment of resources refers to resources that are renewable only over a long period of time such as soil productivity or nonrenewable resources such as cultural artifacts. The following irreversible actions would result from alternatives which allow construction and the proposed action:

-road and pipeline construction in areas which are currently unroaded,
-installation of water diversion structures in streams which are not currently impeded,
-inundation of meadow areas by raising reservoirs which would change habitat characteristics.

Alternative action E would result in the construction of the fewest miles of road, collection pipeline, and produce the smallest overall impact on resources of all the action alternatives. Alternative D impacts would be great because of reservoir inundation. Alternative B would produce more irreversible effects in all three categories. Alternative C, the preferred alternative, would have the smallest negative effect on resources and yet develop a portion of the original proposal. Alternative A which maintains the present level of development, would have a small effect on resources, but it would not mitigate negative effects of Stage I diversions.

Irretrievable commitment of resources is defined as the production or use of renewable resources lost because of a specific action. Within the scope of the proposed action or other alternatives the irretrievable commitments are:

-from 110 to 764 acres of timber production lost due to road construction and reservoir enlargement,
-varying amounts of acreage removed from consideration as wilderness.
-the loss of fisheries habitat which was explained and quantified under Section B, Resource Element Impacts.

-minerals around Rob Roy below the high water line would not be extracted.

E. SUMMARY OF PROBABLE ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Implementation of the proposed action or the other action alternatives will result in some adverse environmental effects that cannot be avoided. There would be from 992 to 1,449 acres of range and wildlife habitat lost by raising the levels, of Hog Park, Rob Roy, and/or Little Snake Reservoirs.

The losses have been mitigated with the exception of the wildlife grass seeding, and aspen management. These measures involve 400 and 160 acres respectively and are temporary, not to be repeated after the initial treatment. It should also be noted that restriction on development of 340 acres of land near Rob Roy Reservoir would only preserve habitat presently available and will not provide additional habitat to compensate for lost acreage.

Action Alternatives B, C, and D could result in 15,800 to 19,500 acre-feet depleted in the Colorado River drainage. There are other projects planned for the Little Snake River basin which would also add to this water depletion. Potential water development reservoirs in the Yampa River Basin are listed in Appendix IV, Table IV-1, Revised Draft Appendix.

F. POTENTIAL CUMULATIVE IMPACTS

There are many proposals for additional water development in the Colorado River basin. New demands are particularly prevalent in the Yampa River basin of which the Little Snake River is the principal tributary. Many of the new demands are associated with development of coal and other energy resources. Water needs for energy development include coal processing and reclamation of mined areas; cooling water for power plants, coal gasification, and recovery of oil from oil shale; and municipal industrial growth associated with the energy development. Additional irrigation and hydropower development in the basin and new diversions of water to cities on the east slope of the Continental Divide could also add appreciably to future water demands.

There are large amounts of coal reserves in the Yampa River basin. Development of this coal has already begun. Water use figures have been projected for an annual production of 35 million tons (National Park Service, 1979). Of this total, about 4.4 million tons/year is already being consumed by existing coal-fired power plants. These existing plants use 12,000 acre-feet of water annually.

The mining and processing of 35 million tons of coal annually would require 644 to 62,900 acre-feet/year depending upon reclamation and other factors. The water requirements to convert the 30.6 million tons of surplus coal (35,000,000 tons less 4,400,000 tons) annually to electricity or other usable energy would depend upon conversion methods. If the surplus was transported out of the area by coal slurry pipelines, about 23,250 acre-feet of water annually would be required. If all of the surplus coal was gasified using plants with cooling towers, the annual consumptive use of water would be about 130,000 acre-feet. If once-through cooling was used, the consumptive use would be reduced about 90 percent, but this would require twice the annual flow of the Yampa River which would result in unacceptable water temperature changes. If all of the surplus coal was used to generate electricity in the basin, the annual water requirements would not be significantly less than for coal gasification. Again, cooling methods would have the main influence on water requirements.

Abundant oil shale deposits are located in western Colorado. Estimates of the amount of water necessary to support the maximum projected production capacity of one million barrels a day range from 151,000 to 250,000 acre-feet annually (National Park Service, 1979). However, the main deposits are located in the White River basin, another tributary of the Green River located south of the Yampa River basin. Therefore, cumulative depletion would not result until 50 miles downstream from the mouth of the Yampa unless Yampa River flows were diverted to the White River basin. Some of the new conversion processes require very little water. Therefore, it appears unlikely that significant quantities of water from the Yampa River basin will be required for oil shale development.

Energy development would cause population growth which, in turn, would increase municipal water requirements. However, municipal water needs are low in relation to other uses and most of the water is returned to streams after waste treatment. New municipal water needs are not expected to exceed 2,000 acre-feet/year.

About 30 new reservoirs have been proposed for the Yampa River basin. Appendix IV, p. IV-124, of the Revised Draft Appendix, lists reservoirs for which information is available. The aggregate storage for proposed irrigation projects is in excess of 400,000 acre-feet. Annual depletions to streamflow would be considerably less since not all storage would be devoted to irrigation and return flows would partially offset depletions. Storage in proposed reservoirs devoted to power generation totals almost 2,000,000 acre-feet, but most storage would be for hydropower which is not a water consumer except for reservoir evaporation losses. Hydropower generation would, however, result in significant changes in river flow regimes.

Almost all new reservoir development would be located in the Yampa River basin upstream from the Little Snake River. The only proposed project which would be located in the Little Snake River basin is the Savery-Pot Hook project of the U.S. Bureau of Reclamation. Two reservoirs would be constructed - one on Savery Creek in Wyoming and the other on Slater Creek in Colorado. These two reservoirs would contain 75,500 acre-feet of storage and result in streamflow depletions of 22,500 acre-feet/year.

The Little Snake River Water Management Project (LSRWMP), more commonly known as Stage III, has recently been proposed by the State of Wyoming (Wyoming Water Development Commission, 1980). This potential project would allow a wide range of water uses including energy development, municipal and irrigation uses, transbasin diversion to east slope communities, and possibly hydropower development.

Six alternative development plans for LSRWMP were studied using combinations of transbasin diversions located at the headwaters of Battle and Savery Creek northwest of Stage I and reservoirs located downstream on Savery Creek, North Fork, Slater Creek, or the Little Snake River. Two of the reservoir sites would be essentially the same as the Bureau of Reclamation proposed Savery-Pot Hook project. The most economical plan for transbasin diversion includes a pipeline conveying water from diversion structures located in the upper watersheds to a tunnel under the Continental Divide. The water would be stored in Jack Creek Reservoir on the east side and releases would be piped to the North Platte River for municipal use downstream. The downstream reservoirs (generally two sites per alternative) would regulate snowmelt runoff for municipal, industrial, and irrigation uses in the Little Snake River basin in Wyoming.

Under each of the alternatives, about 30,000 acre-feet/year would be diverted to the North Platte River. The downstream reservoir combinations would yield from 68,100 to 145,200 acre-feet/year for inbasin use as follows:

Inbasin Use	Projected Needs (acre-feet/year)
Municipal (Baggs, Dixon, and Savery)	800
Industrial (Kemmerer Coal, Tri-State, and Others)	55,010
Irrigation (maximum shortage - Savery Creek and Little Snake River)	17,080

Two of the plans would not quite satisfy all inbasin needs while four would yield excess water which could be used for hydropower generation or for other uses. The net depletion to Little Snake River streamflow under the six alternative plans would vary from 82,840 to 113,750 acre-feet/year.

It is not possible to project with any degree of certainty what projects will be constructed in the upper Colorado River basin in the future. Given the limitations on water supply, the protective provisions of the Endangered Species Act, potential Federal reserve water rights for Dinosour National Monument located downstream from the mouth of the Little Snake River, and other constraints, it is very doubtful all projects could be constructed. However, based on the large amount of proposed development, it is quite evident that new uses for the waters of the Little Snake and upper Yampa Rivers will be developed in the future resulting in the potential for cumulative impacts. The following Table IV-4 is a summary of potential future depletions assuming a reasonable worst case analysis.

TABLE IV-4

CUMULATIVE DEPLETIONS IN THE UPPER COLORADO RIVER BASIN

Project or Use	Annual Depletion (AF/yr.)
Coal Development	
a. Processing & reclamation	30,000
b. Coal Gasification/electrical generation	70,000
Oil Shale Development	10,000
Municipal Growth	2,000
Irrigation	60,000 1/
Lower Snake River Water Management Project	95,000
Total	267,000 2/

In combination with proposed Stage II depletions, cumulative depletions would total about 285,000 acre-feet/year above the mouth of the Yampa River of which 115,000 acre-feet/year of the new depletions would occur in the Little Snake River basin. The summary of effects on streamflows and salt concentrations at several downstream points based on the cumulative development is in Appendix IV, p. IV-2.

1/ Assumes half of irrigation reservoirs developed, 75% active storage, 20% annual carryover, and 50% irrigation return flows.

2/ Does not include depletions which would result from Stage II diversions.

ENVIRONMENTAL IMPACTS

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
1. Economics					
a. Amount of Water Produced for Cheyenne Total/Additional -Acre-feet	14,700 / 0	34,200 / 19,500	30,500 / 15,800	32,700 / 18,000	27,700 / 13,000
b. Cost to Consumer - Rate/1000 gal.-1980 Dollars (Low Use) 1/ - Rate/Acre-foot	$.87 / $294	$2.33 / $790	$2.53 / $858	$4.38 / $1429	$2.33 / $788
c. Cost to Consumer - Rate/1000 gal.-1980 Dollars (High Use) 2/ -Rate/Acre-foot	$.60 / $203	$1.61 / $545	$1.74 / $592	$3.01 / $981	$1.61 / $543
d. Cost to Cheyenne -Rate/1000 gal.-1980 Dollars -Rate/Acre-foot	$.29 / $97	$1.16 / $393	$1.26 / $427	$2.18 / $711	$1.16 / $392
e. Project Construction Costs -1980 Dollars	0	$100,355,000	$83,346,000	$138,543,000	$53,453,000
f. Annual Maintenance Costs Do Not Include Annual Special Use Fees -1980 Dollars	$50,000	$126,500	$114,500	$2,405,000	$1,102,200
g. Forest Service Administrative Costs Construction Monitoring -1980 Dollars	0 / $620	$62,000 / $990	$57,000 / $990	$37,200 / $774	$15,000 / $700
h. Electrical Power Consumed - Killowatt Hours	14,700	14,700	14,700	33,320,000	5,514,400
i. Term of Supply at Current Consumption Rates High Growth Rate -Without Cons. -With Cons.	1980 / 1981	2010 / 2039	2004 / 2027	2008 / 2027	2000 / 2018
Average Growth Rate -Without Cons. -With Cons.	1980 / 1983	2032 / 2070+	2022 / 2070+	2028 / 2070+	2015 / 2070+
Low Growth Rate -Without Cons. -With Cons.	1982 / 2040	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+	2070+ / 2070+
2. Resource Management					
a. Watershed 1) Riparian Habitat -Acres Lost/Net after Mitigation	(-) 0 / (+) 0	(-) 454 / (-) 354	(-) 454 / (-) 354	(-) 459 / (-) 359	(-) 0 / (+) 0
2) Salinity Increase Range - mg /liter (Colorado River at Imperial Dam)	0	1.89 - 2.17	1.53 - 1.76	1.89 - 2.17	0
b. Fisheries 1) Game Species Existing	4	4	4	4	4
2) Trout Streams Diverted	0	13	11	4	4
3) Miles of Stream - Lost - Net miles after Mitigation	(-) 0 / (+) 0	(-) 9.7 / (-) 5.1	(-) 9.7 / (-) 5.1	(-) 14.6 / (-) 10.0	(-) 0 / (+) 0
4) Total Stage II Trout Habitat Units -Lost -Net Habitat Units after Mitigation	(-) 0 / (+) 0	(-) 484 / (+) 15	(-) 457 / (+) 40	(-) 1138 / (-) 627	(-) 18 / (+) 221
5) Colorado River Cutthroat Trout 3/ -Habitat Units Lost -Net Habitat Units after Mitigation	(-) 270 / (-) 270	(-) 291 / (-) 39	(-) 291 / (-) 39	(-) 270 / (-) 18	(-) 270 / (-) 270
6) Stage I Trout Habitat Units -Lost Due to Inadequate Streamflows -Regained by Providing Streamflows	(-) 811 / (+) 0	(-) 811 / (+) 811	(-) 811 / (+) 811	(-) 811 / (+) 811	(-) 811 / (+) 0
c. Recreation 1) Potential Dispersed Recreation Change Semi-Primitive to Rural - Acres	0	8,400	6,300	2,700	0
2) Developed Recreation Sites Displaced and Relocated - PAOT	0	375	375	375	0
d. Wilderness Potential 1) Acres Available	67,322	62,112	65,892	67,322	67,322
2) Character Rating	0	(-) 24	(-) 9	(-) 1	0

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
e. Soils 1) Surface Disturbance -Acres	0	2,675	2,552	3,079	340
2) Mass Land Failure Potential (Can be Mitigated by Design) -Acres	0	714	150	740	0
3) Areas of Very Low Revegetation Potential -Acres	0	587	320	500	0
f. Range - Grazing Capacity - AUM's Lost	0	447	408	455	0
g. Terrestrial Wildlife 1) Game Species Present Number of Species	17	17	17	17	17
2) Nongame Species Present Number of Species	230	230	230	230	230
3) Habitat -Acres Lost -Net Acres after Mitigation	(-) 0 / (+) 0	(-) 1078 / (-) 78	(-) 992 / (+) 8	(-) 1449 / (-) 449	(-) 0 / (+) 0
4) Consumptive Use - User Days	1,100	2,500	2,500	1,100	1,100
5) Nonconsumptive Use - User Days	100	300	300	100	100
h. Threatened or Endangered Fish Species - Present Downstream	3	3	3	3	3
i. Visual Resources - Acres of Outstanding Quality Altered	0	493	493	293	0
j. Tree Resource - Acres Lost	0	532	450	764	110
k. Transportation - New Road Construction - Miles	0	29.6	22.7	15.7	11.9
l. Cultural Resources - Acres Needing Survey	0	2,675	2,552	3,079	340
. State-County Plans a. State Plans 1) Meets Goals Land Plan	100%	100%	100%	100%	100%
2) Meets Goals Water Plan 4/	0%	97%	80%	90%	0%
b. County Plans 1) Meets Goals Land Plan	100%	100%	100%	100%	100%
2) Meets Goals Water Plan	0%	100%	87%	100%	0%
3) Domestic Water Use	0%	100%	87%	100%	30%

1/ Low Use = Primarily residential use of less than 250,000 gallons per month.

2/ High Use = Primarily commercial use of more than 250,000 gallons per month. .60/100 gal. is charged after 250,000 is reac

3/ Habitat units for Colorado River Cutthroat Trout are cumulative for Stage I and Stage II because of the "Sensitive" status of this subspecies in Wyoming and because the North Fork drainage is essential to its continued existence.

4/ Full development of unobligated surface water supplies would equal 100%.

○ DOES NOT RESOLVE ISSUE

◒ POTENTIAL TO RESOLVE ISSUE AT LEAST PARTIALLY (50%)

● POTENTIAL TO RESOLVE ISSUE TOTALLY

4. <u>Potential to Resolve Public Issues</u> 1/

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E
a. Alternative Water Sources to Stage II	●	○	○	○	●
b. Increased Stream Flows	●	◒	◒	◒	●
c. Decreased Stream Flows	○	●	●	●	○
d. Reservoir Fluctuation	●	◒	◒	◒	◒
e. Colorado River Salinity	●	◒	◒	◒	●
f. New Access into Unroaded Areas	●	◒	◒	●	●
g. Fish Habitat	●	◒	◒	●	●
h. Downstream Water Users	●	◒	◒	●	●
i. Threatened or Endangered Species	●	●	●	●	●
j. Terrestrial Wildlife Impacts	●	○	○	○	●
k. Water Supplies to Other Communities	○	●	◒	●	○
l. Reservoir Safety	●	●	●	●	●
m. Development of Compact Allocated Water	○	◒	◒	●	○
n. Role of Water Conservation Maximized	●	◒	◒	◒	●

1/ Resolution Potential includes mitigation specified for each action alternative.

V. LIST OF PREPARERS

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V. LIST OF PREPARERS

A. TEAM INVOLVEMENT CHEYENNE STAGE II WATER DIVERSION

MEDICINE BOW NATIONAL FOREST PREPARERS

MANAGEMENT TEAM

Member	Speciality
Donald L. Rollens	Forest Supervisor
Ladd G. Frary	Resource Staff Officer
John Gillum	Forest Engineering Staff Officer
Ron Olsen	Land Planning Staff Officer
John T. Quinn	Resource Staff Officer

INTERDISCIPLINARY TEAM

Member	Specialty
Don M. Bolinger	Project Coordinator
Ron Bauer	Soils Management
William Blunt	Wildlife Management
Tim Chesley	Engineering
Clair Finley	Timber Management
Dennis Jespersen	Fisheries
Chris Marvel	Landscape Architecture
John Nordin	Soils Management
Donald Schmidtlein	Range
Peter Stewart	Hydrology
Raymond Urbom	Recreation

IN SERVICE SPECIALIST INPUT

Greg Bevinger	Hayden Ranger District	Hydrology
Terry Hoffman	Laramie Ranger District	District Ranger
Richard Moore	Regional Fisheries Biologist	Fisheries
Joe Remick	Hayden Ranger District	Range
Larry Thoney	Hayden Ranger District	District Ranger
Kent Van	Laramie Ranger District	Range

COOPERATING AGENCY PREPARERS

Joe Bohne	Wyoming Game and Fish	Wildlife
Nelson Carpenter	Army Corps of Engineers	Socioeconomics
Mike Erwin	U.S. Fish & Wildlife Service	Wildlife
Gary Johnson	Environmental Protection Agency	EIS Specialist
Larry Lockard	U.S. Fish & Wildlife Service	Fisheries
Don Miller	Wyoming Game & Fish	Wildlife
Jack Neuman	Wyoming Game & Fish	Wildlife
Gene Reetz	Environmental Protection Agency	Water Resource
Robert Roumph	Army Corps of Engineers	Engineering
Fred Stabler	Bureau of Land Management	Hydrology
Mike Stone	Wyoming Game & Fish	Fisheries

B. TEAM ACCREDITATION

1. Management Team

a. Donald L. Rollens - Forest Supervisor, Medicine Bow National Forest. B.S. Forest Management, University of Missouri. Twenty-one years experience with Forest Service USDA. Majority of experience is in line positions, including: District Ranger, Deputy Forest Supervisor and Forest Supervisor. Experience on seven National Forests, Regional Office and two Forest Service Regions.

b. Ladd G. Frary - Resource Staff Officer, Medicine Bow National Forest. B.S. and M.S. Wildlife Management, Colorado State University. Eighteen years experience with Forest Service USDA. Nine years as District Ranger and eight years in Range and Wildlife staff positions. Prior to employment with the Forest Service, spent eight years in Wildlife Research and Management with Colorado, South Dakota and New Mexico Game and Fish Departments.

c. John Gillum - Forest Engineering Staff Officer, Medicine Bow National Forest. B.S. Civil Engineering, University of Kansas. Registered Professional Engineer in states of Wyoming and South Dakota. EIT in Kansas. Nineteen years experience in Civil Engineering with Forest Service USDA on three Forests and Regional Office. Approximately one year of experience with Kansas State Highway Department.

d. Terry Hoffman - District Ranger, Laramie District. B.S. Forestry, University of Michigan. Fourteen years experience Forest Service USDA, including seven years Resource Forester, seven years District Ranger.

e. Ron Olsen - Land Planning Staff Officer, Medicine Bow National Forest. B.S. Forestry, University of Minnesota. Eighteen and one-half years experience with Forest Service USDA, including: two years Timber Forester, six years Watershed Specialist, ten years Planning Staff Officer.

f. John T. Quinn - Resource Staff Officer, Medicine Bow National Forest. B.S. Range Management, Mississippi State University. M.S. Forestry, Utah State University. Post Graduate, Political Science, Syracuse University. Twenty-two years Forest Service, USDA experience, including: seven years District Ranger, six years Timber and Fire Staff, two years Land Planning, and three years Supervisory Forester Staff.

g. Larry Thoney - District Ranger, Hayden District. B.S. Forest Management, Michigan State University. Thirteen years experience Forest Service USDA, including: two years District Ranger, two and one-half years Timber

Project Staff, three years Timber Special Uses District, two years Assistant Ranger, three years Timber.

2. Interdisciplinary Team

a. Don M. Bolinger - Special Projects Coordinator, Medicine Bow National Forest. B.S. Forest Management, Iowa State University. Seventeen years experience Forest Service USDA, including: six years Assistant Rangèr - Timber Recreation and Land Uses, seven years Range and Fire Management, four years Special Projects and Environmental Coordinator.

b. Ronald Bauer - Soil and Water Project Staff, Medicine Bow National Forest. B.S. General Agriculture, Colorado State University. Nineteen years experience with Forest Service USDA in Regional Office and San Juan National Forest in Soil Survey and special projects, and as Soil Survey Party Chief.

c. William H. Blunt - Wildlife Biologist, Medicine Bow National Forest. B.S. Wildlife Management, Colorado State University. Twenty years with Forest Service USDA working in all resource fields with special emphasis in Wildlife, Range, and Timber management. Experience on five National Forests, six Ranger Districts and three Supervisor's Offices.

d. Charles T. Chesley - Civil Engineer, Medicine Bow National Forest. B.S. Civil Engineering University of New Hampshire. Five years experience Forest Service USDA in Civil Engineering in White Mountains National Forest, Superior National Forest, and Medicine Bow National Forest.

e. Clair Finley - Forester (Silviculture), Medicine Bow National Forest. B.S. Outdoor Recreation, Colorado State University. Eleven years experience Forest Service USDA, including: eight years in White River and Medicine Bow National Forests.

f. Dennis Jespersen - Fisheries Biologist, Medicine Bow National Forest. B.S. Biology, M.S. Fisheries Management, University of Wyoming. Two years experience Forest Service USDA, Fisheries, and six months experience Wyoming Game and Fish.

g. Chris Marvel - Forest Landscape Architect, Medicine Bow National Forest. Bachelor of Landscape Architecture, SUNY College of Environmental Science and Forestry at Syracuse University. Two years experience Forest Service USDA, eight years New York State Department of Transportation, Registered Landscape Architect New York State, two years private practice.

h. John Nordin - Soil Management Specialist, Medicine Bow National Forest. M.S. and B.S. in Soil Science, University of Minnesota. Six years experience with Soil Conservation Service and one year experience with Forest Service USDA.

i. Donald W. Schmidtlein - Range Staff, Medicine Bow National Forest. B.S. Range Management, Utah State University. Twenty-four years Forest Service USDA, including: five years District Ranger, seven years Regional Offices. Experience on four National Forests as Range Conservationist, Assistant Ranger, Ranger, and Range Staff. Prior twenty years experience ranching Nevada and Idaho.

j. Pete Stewart - B.S. Watershed Management, University of Arizona. Ten years total experience with Forest Service USDA, including: four years Fire Management, five years Watershed Management. One year Job Corps - YCC.

k. Ray Urbom - Recreation and Lands Staff Officer, Medicine Bow National Forest. B.S. Forest Management, Utah State University. Thirty years experience with Forest Service USDA working in Idaho, Colorado, and Wyoming. District Ranger for thirteen years on three Ranger Districts in Colorado. Recreation and Lands Staff on Medicine Bow since 1968.

3. Cooperating Federal and State Agencies

a. Nelson S. Carpenter - Community Planner, Omaha District, U.S. Army Corps of Engineers. B.S. degree in Urban Studies/ Planning, University of Nebraska at Omaha. Five years experience in flood damage analysis and water resources planning with Corps of Engineers.

b. Mike Erwin - Fish and Wildlife Biologist, Billings Area Office, U.S. Fish and Wildlife Service (USFWS). B.S. Wildlife Management, Utah State University; M.S. Wildlife and Resource Science, University of California - Berkeley. Six years experience with USFWS in fish and wildlife planning for land and water development projects in Montana and Wyoming.

c. Larry Lockard - Fish and Wildlife Biologist, Billings Area Office, U.S. Fish and Wildlife Service (USFWS). B.S. and M.S. Fish and Wildlife Management, Montana State University. One year experience with Montana Department of Fish, Wildlife, and Parks and six years experience with USFWS in fish and wildlife planning for land and water development projects in Montana, Wyoming, South Dakota, and Nebraska.

d. Dave Kaumheimer - Wildlife Biologist, Billings Area Office, U.S. Fish and Wildlife Service (USFWS). B.S. Wildlife Ecology, University of Wisconsin - Madison; M.S.

Wildlife Management, University of Idaho. Two years experience State of Idaho and two years experience with USFWS in wildlife planning for land and water development projects in Montana and Wyoming.

e. Gene R. Reetz - Physical Scientist, EPA Region VIII. Ph.D. Natural Resources Conservation, Cornell University; M.S. Hydrology, University of Arizona; B.S. Physical Science, Colorado State University. Eight years experience as a hydrologist and water resources specialist with local, State and federal agencies. Three years teaching and research, Department of Natural Resources, Cornell University.

f. Robert F. Roumph - Civil Engineer, Omaha District, U.S. Army Corps of Engineers. B.S. in Civil Engineering and M.S. in Water Resources Engineering, University of Nebraska/Lincoln. Five years experience in water resources planning and EIS review, Corps of Engineers; three years experience water resources planning and EIS preparation with private engineering consulting firm; and three years experience with State of Nebraska developing State Water Plan.

VI. LIST OF AGENCIES, ORGANIZATIONS & PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

VI. LIST OF AGENCIES, ORGANIZATIONS & PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

The following agencies, organizations, and individuals received copies of the original Draft Environmental Statement, and/or copies of the Revised DEIS, Cheyenne Stage II Water Diversion.

A. DISTRIBUTION OF DRAFT AND/OR REVISED DRAFT STATEMENTS

1. Federal Agencies

Advisory Council on Historic Preservation, Office of Architectural and Environmental Preservation

Army Corps of Engineers, Omaha District Office

Council on Environmental Quality, Chairman

Department of Agriculture:
-Agriculture Stabilization and Conservation Service
-Cooperative Extension Service
College of Agriculture, University of Wyoming
-Environmental Quality Activities, Office of the Secretary
-High Plains Grassland Research Station
-Rocky Mountain Forest and Range Experiment Station, Ft. Collins
-Rocky Mountain Forest and Range Experiment Station, Laramie
-Soil Conservation Service
Environmental Services Division
-Soil Conservation Service, National Forester
-Soil Conservation Service
State Conservationist
-Soil Conservation Service
Laramie Field Office
-Soil Conservation Service, Saratoga Field Office
-Soil Conservation Service, Baggs Field Office
-Soil Conservation Service, Colorado River Big Country
-Forest Service, Region II
-Forest Service
Arapaho and Roosevelt N.F.
Bighorn N.F.
Black Hills N.F.
Grand Mesa-Uncompahgre & Gunnison N.F.
Nebraska N.F.
Pike & San Isabel N.F.
Rio Grande N.F.
Routt N.F.
San Juan N.F.
Shoshone N.F.
White River N.F.

Department of Commerce:
-Director of Regulatory Policy
-Asst. Sec. for Productivity, Technology, & Innovation

Department of Interior:
-Bureau of Land Management
District Office, Rawlins, Wyoming
-Bureau of Land Management
State Director
-Bureau of Reclamation
Upper Colorado Regional Office
-Director, Environmental Project Review
-National Park Service
Denver Service Center
-National Park Service
Dinosaur National Monument
-National Park Service
Rocky Mountain Region
-U.S. Fish and Wildlife Service
Area Manager, Salt Lake City, Utah
-U.S. Fish and Wildlife Service
Office of Environmental Coordination
-U.S. Fish and Wildlife Service
Regional Director, Denver, Colorado
-U.S. Fish and Wildlife Service,
Cheyenne Office and Billings Office
-U.S. Geological Survey
-Water and Power Resource Service
Cheyenne and Casper, Wyoming

Department of Energy:
-Office of the Environment

Environmental Protection Agency:
-Environmental Impact Statement Review Coordinator
-Office of Federal Activities
-Region VIII

Federal Energy Regulatory Commission
Advisor on Environmental Quality

Missouri River Basin Commission
Executive Secretary

Rural Electrification Administration
Management Analysis and Services Branch
Water Resources Council

2. State Agencies

California, State Hydrologic Engineer
Colorado Division of Wildlife
Colorado River Board of California

Colorado State University: Morgan Library, Department of Earth Resources, Department of Fishery and Wildlife Biology
Geological Survey of Wyoming
University of Montana: School of Forestry (Wilderness Institute)
University of Wyoming: Coe Library and Department of Recreation and Parks Administration
Wyoming Commissioner of Public Lands
Wyoming Conservation Commission
Wyoming Department of Agriculture
Wyoming Department of Economic Planning and Development
Wyoming Department of Environmental Quality
Wyoming Game and Fish Department Laramie, Cheyenne
Wyoming Recreation Commission
Wyoming State Engineers Office
Wyoming State Forester
Wyoming State Planning Coordinating Office
Wyoming Water Development Commission
Wyoming Water Planning Program

3. <u>County and Local Agencies</u>

Albany County Commissioners
Albany County Extension Agent
Albany County Planning Office
Carbon County Commissioners
Carbon County Extension Agent
Carbon County Planning and Zoning Commission
Casper Board of Public Utilities
Central Nebraska Public Power and Irrigation District
Cheyenne Board of Public Utilities
Cheyenne City Council
Cheyenne Water Board
City of Cheyenne, Wyoming
City of Craig, Colorado
City of Laramie, Wyoming
City of Rawlins, Wyoming
City of Slater, Colorado
Hot Springs County Planning Commission
Laramie County Commissioners
Laramie County Extension Agent
Laramie County Planning Department
Library Casper, Wyoming
Library Cheyenne, Wyoming
Library Craig, Colorado
Library Denver, Colorado
Library Douglas, Wyoming
Library Encampment, Wyoming
Library Laramie, Wyoming
Library Rawlins, Wyoming

Library Saratoga, Wyoming
Library Wheatland, Wyoming
Natrona County Planning Office
Sweetwater County Commissioners
Town of Baggs
Town of Dixon
Town of Encampment
Town of Saratoga

4. Organizations

American Fisheries Society, Wyo-Colo Chapter
American Association of University Women
American Mining Congress
American Wilderness Alliance
Arizona River Runners, Inc.
Associated General Contractors of Wyoming
Baggs Lions Club
Baggs Sportsman Club
Barker-Ewing, Inc.
Bighorn Lumber
Brandt and Wicklund
Burns and McDonnell
Business Committee, Cheyenne-Arapaho Tribes of Oklahoma
Casper Chamber of Commerce
Carbon County Conservation Club
Carbon County Farm Bureau
Carbon County Utilities Coordinating Council
Cheyenne Chamber of Commerce
Cheyenne High Plains Audubon Society
Citizens for Good Government
Colorado Farm Bureau
Colorado Open Space Council
Colorado West Council of Government
Community Action, Cheyenne, Wyoming
Continental Divide Water Coalition
David D. Smith & Associates
Defenders of Wildlife, National and Wyoming
Divide Sheep Trust
Don Hatch River Expeditions, Inc.
Encampment-Riverside Lions Club
The Environmental Defense Fund
Environmental Research and Technology
Fast Water Expeditions
Federal Timber Purchasers Association
Federation of Fly Fishermen
Foundation for Urban and Neighborhood Development
Friends of the Earth
Grand Canyon Dories
Hammer Lumber Co.
Harza Engineering
Hines Lumber Company

Holiday River Expeditions, Inc.
International Snowmobile Industry Association
Izaak Walton League of America, Colorado
Izaak Walton League, Arapahoe Chapter
Izaak Walton League, Blue Spruce Chapter
Izaak Walton League, Cheyenne Chapter
Izaak Walton League, Front Range Chapter
Izaak Walton League, Travell Chapter
Izaak Walton League, Wyoming Division
Ken Slight Expeditions
Lake Creek Landowners Association
Laramie Chamber of Commerce
Laramie Lions Club
Laramie Plains Lions Club
Laramie Wilderness Coalition
League of Women Voters, Cheyenne
League of Women Voters, Laramie, Rawlins
Maki Mac River Expeditions
National Audubon Society:
Alpine Chapter
Fremont County Chapter
Murie Chapter
National Forest Recreation Association
National Wildlife Federation, Natural Resource Clinic
National Wildlife Federation, Wyoming Chapter
Nature Conservancy
North American River Expeditions
North Platte Citizens Committee
Platte River Outfitters
Professional River Outfitters Association
Rawlins-Carbon County Chamber of Commerce
Rawlins Saddle Club
Rawlins Snowmobile Club
Rocky Mountain Expedition
Saratoga Farm Bureau
Saratoga-Platte Valley Chamber of Commerce
Sheridan-Little Horn Water Group
Sierra Club Legal Defense Fund
Sierra Club, Northern Great Plains Office
Sierra Club, Regional Representative
Sierra Club, Assistant Representative
Sierra Club, Wyoming Chapter
Sierra Club, Snowy Range Chapter
Tag-Along Tours
Texas River Expeditions
Trout Unlimited - Colorado Chapter
Trout Unlimited - National Headquarters
Unique Adventure on Wilderness Rivers
Viking River Expeditions
Ways West River/Trail Adventures
Western Adventure Safari, Inc.
Western Forest Industries Assocation

Western Ranchman Outfitters
Western River Expeditions
Western River Guides Association
White River Odyssey
Wild and Scenic, Inc.
Wilderness Aware
Wilderness Society
Wilderness World
Wildlife Management Institute, Western Representative
Wildlife Society, Wyoming Chapter
Woodward and Clyde Associates
Wyoming Association of Municipalities
Wyoming Farm Bureau
Wyoming Outdoor Council
Wyoming Stockgrowers' Association
Wyoming Wildlife Federation
Wyoming Woolgrowers' Association

5. Elected Officials

Honorable Richard B. Cheney
House of Representatives

Honorable Alan K. Simpson
United States Senate

Honorable Malcolm Wallop
United States Senate

Honorable Edward Herschler
Governor of Wyoming

Wendy Ockers
Field Representative for Congressman Richard B. Cheney

Debbie Maxon
Field Representative for Senator Alan K. Simpson

Byra Kite
State Representative for Senator Malcolm Wallop

Honorable Shelia Arnold
Wyoming State Representative
Albany County

Honorable June Boyle
Wyoming State Senator
Albany County

Honorable Bob J. Burnett
Wyoming State Representative
Albany County

Honorable Earl Christensen
Wyoming State Senator
Crook/Weston County

Honorable Ellen Crowley
Wyoming State Representative
Laramie county

Honorable O. R. "Bud" Daily
Wyoming State Senator
Carbon County

Honorable Russ Donley
Wyoming State Representative
Natrona County

Honorable William C. Edwards
Wyoming State Representative
Laramie County

Honorable Matilda Hansen
Wyoming State Representative
Albany County

Honorable T. A. Larson
Wyoming State Representative
Albany County

Honorable C. M. Lummis
Wyoming State Representative
Laramie County

Honorable Patti MacMillan
Wyoming State Representative
Albany County

Honorable Rodger McDaniel
Wyoming State Senator
Laramie County

Honorable Bill McIlvain
Wyoming State Representative
Laramie County

Honorable B. G. "Jerry" Michie
Wyoming State Representative
Carbon County

Honorable Edward D. Moore
Wyoming State Senator
Converse-Niobrara Counties

Honorable Wm. M. "Bill" Murray
Wyoming State Senator
Laramie County

Honorable David R. Nichols
Wyoming State Senator
Albany County

Honorable Milton E. Nichols
Wyoming State Senator
Laramie County

Honorable J. W. "Jim" Norris
Wyoming State Senator
Laramie County

Honorable Carrol P. Orrison
Wyoming State Representative
Laramie County

Honorable Dean Prosser Jr.
Wyoming State Representative
Laramie County

Honorable W. G. "Bill" Rector
Wyoming State Senator
Laramie County

Honorable George R. Salisbury, Jr.
Wyoming State Representative
Laramie County

Honorable Mary K. Schwope
Wyoming State Representative
Laramie County

Honorable Charles K. Scott
Wyoming State Representative
Natrona County

Honorable Marlene Simons
Wyoming State Representative
Crook County

Honorable Thomas E. Trowbridge
Wyoming State Representative
Carbon County

Honorable Pat Tugman
Wyoming State Representative
Laramie County

Honorable Walter C. Urbigkit, Jr.
Wyoming State Representative
Laramie County

Honorable Alvin Wiederspahn
Wyoming State Representative
Laramie County

6. Media

Black Hills Forest Product News
Branding Iron
Casper Star Tribune
Daily Times
Denver Post, Inc.
Douglas Budget
Glenrock Independent
High Country News
Journal Publication
KATI Radio Station
KFBC Radio Station
KOJO Radio Station
KOWB Radio Inc.
KRAE Radio Station
KRAL Radio Station
KTWO-TV and Radio News Bureau
KYOC Radio Station
KYCU-TV Station
Laramie Daily Boomerang
News Record
Platte County Records-Times
Rocky Mountain News
Saratoga Sun
Snake River Press
Torrington Telegram
United Press International
WCCM, Curt Gowdy Radio Station
Wyoming State Tribune

7. Indian Tribes

Cheyenne-Arapahoe Tribes
Crow Tribe of Indians
Shoshone Business Council
Ute Mountain Tribal Council

8. Individuals and Others

Roger Abelson and Class
Robert G. Afflerbach

Maxine Albers
Robert Allen
Berger Anderson
John Arnett

Dick Barkhurst
Joan Barron
Bryon A. Barry, Jr.
Battle Mountain Co.
George T. Baxter
Ron Beiswenger
Jim Berger
Harold Bergman
Eric Bergmann
Priscilla Bernaski
Mr. and Mrs. Bill Bess
Allen Binns
Phillip Birks
Hans Blieker
Sarah Bond
Brian Borofka
Russ Bovaird
George Boyer
Sean Bradley
Kenneth Brengle, Jr.
Mark Brosseau
Marshall E. Broyles
Pam Bullington
Paul Bujak
Collen Cabot
Bob Campbell
Robert A. Campbell
Sean Carmen
Mrs. Floyd Chamberlain
Art Champs
R. J. Cinq-Mars
Roger Clark
Tim Clark
John T. Cobb
Frank M. Cole
Dean Conine
Myra Connell
Frank Connelly
James E. Cowan
Dean Cowles
Dwain W. Cruse

Jeanne Dabney
W. R. Daley
Mead O. Davis

Tilton Davis, IV
Jean Denison
Kenneth L. Diem
Mrs. Dan Dillinger
A. W. Dowdy
Fred Dowell
Michael Durgain
Fred Eiserman
Donald E. and Jean Ely
Roger Epp
Daisy Epperson
Larry Erickson
Mike Evans
Robert A. Ewing

Mike Fallagan
Martin W. Ferguson
Walter Ferguson, III
Linda Fleming
Mark Fowden
John Freeman
Lewis Freudenthal

John Gassoway
Robert George
Paul Gertsch
William Ginther
Marcia Gladstone
Joe Golden
Kenneth M. Goldsmith
Thomas W. Green
Jim Grieve
Robert Grieve
Dennis Gunnerson

Judith Hart

Stanley K. Hathaway
John Hayes
Lloyd Hayes
Gary Hayter
Myrna Hoadley
Z. Hodurski
Douglas Hoyt
Allen Hughes
Dale Hunt

Peter Illoway

Mrs. Jackson
Lewis Jackson
Thomas R. Jackson

Robert Janzen
Bob Johns
Dave Johnson
Duane Johnson
Norman V. Johnson
John Johnson
J. P. Johnson
Robert Johnson
Rodney D. Johnson
Elmer Johnston
Maurice Jones
Harold Josendahl

Wayne Kammerer
Kim Keaton
Kenneth Kennedy
Duane Keown
Thomas E. Kilty
Larry King
William J. Kirven, Jr.
Bart Koehler
Mike Kolander
Raymond Kunselman

Fran Lanum
Eva Lauer
Mrs. Robert Layborn
Robert A. Lee
Dickie D. Lewis
Ted Lewis
Chris Lidstone
H. K. Lidstone
Harold A. Linke
Linda Linn
Warren Loendorf
W. J. Lucas
Dave Lyndall

Wales Madden, Jr.
LeAnn Marchant
Burton W. Marston
Joe B. Mattern
Allen Mauzy
Leonard S. Mayer
Brien E. McAdams
Robert A. McBride
Betty McCullough
Jennie McDonald
Rory McFarland
Pat McGuire
Harold McKenney

Ron McKnight
R. C. Mead
Howard Meeker
Connie Meister
Joseph S. Meyer
Mrs. Robert Model
Frederick Moleski
Robert Montgomery
Roberta Moore
Katherine Moorehead

Wesley Nash
Chuck Neal
Kenneth Nelson
Cari Nichols
C. Nielsen
James Nobel
Jack Noblitt
Carl Norbeck
Dave Nordwall

Dale Oakes
Bert and Vera Oldman
Charles Overson

Norman Palm
Glen Parker
Barbara Parsons
Cindy Patterson
Forest Payne
Darrell Pendley
Clynn Phillips
Walter J. Pilch
Wayne Platt
Jeanie Poulsen

Bob Quinlan

Paul Rechard
Mr. and Mrs. Don Reed
Terry M. Reidy
Willard C. Rhoads
Jim Richards
William W. Riddell
Robert Righter
J. D. Ritts
D. G. Roberts
E. and W. Roepke
Edward W. and Jean Rogers
Dave Rogers
John Rogers
James F. Ross

Laura Rotegard
Harry Russell

Jerry Sanderson
Thomas Scavo
Floyd Schneider
Jeff Schroeder
Bill Scott
Valerie Seid
Jackie Shubert
Vince Sindt
Jim Sinning
Gerald Sjaastad
Dwight R. Smith
J. B. Spaulding
Rod Squires
Howard Stanley
Pete Stewart
Mrs. Rex A. Stout
Ed Strader
Dan Stroud

Ben Tammney
Angela Tebaldi
Marilyn Thelen
Mrs. David Thomas
Craig Thompson
Lee Trejo
Tom Throgmorten

Robert Vosseller
Raymond D. Vlasin
Ann Vosler

Gwen Waddell
Ann Wagner
Linelle Wagner
Tammy Walling
Donald Warder
Carla Warren
Michael Webber
Sid Weber
Thomas Wesche
Pam Wessels
Archie and Mildred Wheeler
Philip White
Bill Wichers
John Wiener
Louisa Willcox
Jeff Williams
Ruth Wilson
John Winkel
Marvin Wolf
Nelson E. Wren, Jr.

Kathy Youmans

B. RESPONDENTS TO THE ORIGINAL DRAFT STATEMENT

Any individual or organization making written response to the Draft Environmental Impact Statement, "Cheyenne Stage II, Water Diversion Proposal," was included in the following list:

1. Federal Agencies

Army Corps of Engineers
Omaha District Office

Department of Agriculture
-Soil Conservation Service
 State Conservationist

Department of Commerce:
-Assistant Secretary for Productivity, Technology, and
 Innovation
-National Oceanic and Atmospheric Administration

Department of Interior:
-Office of the Secretary
-U.S. Fish and Wildlife Service
 Billings Area Office

Environmental Protection Agency
Region VIII

Federal Energy Regulatory Commission
Advisor on Environmental Quality

2. State Agencies

Colorado River Board of California
Colorado State University, Department of Fisheries and Wildlife Biology
Wyoming Department of Agriculture
Wyoming Department of Economic Planning and Development
Wyoming Department of Environmental Quality
Wyoming Game and Fish Department
Wyoming State Engineer
Wyoming Water Development Commission

3. County and Local Agencies

Cheyenne Board of Public Utilities

4. Organizations

American Association of University Women
American Fisheries Society, Colorado-Wyoming Chapter

American Wilderness Alliance
Cheyenne Chamber of Commerce
Colorado West Council of Government
National Wildlife Federation, Natural Resource Clinic
Trout Unlimited
Colorado Council
Wildlife Society
Wyoming Chapter
Wyoming Wilderness Association
Wyoming Wildlife Federation

5. Elected Officials

Governor Ed Herschler
State of Wyoming

Honorable William M. Murray
Wyoming State Senator
Laramie County

Honorable Elizabeth Phelan
Wyoming State Representative
Laramie County

Honorable Charles K. Scott
Wyoming State Representative
Natrona County

6. Individuals and Others

James L. Applegate
Robert G. Afflerbach
Byron A. Barry, Jr.
George T. Baxter
Harold L. Bergman
R.S. Bradley
Kenneth G. Brengle, Jr.
Marshall E. Broyles
Robert A. Campbell
Mrs. Floyd Chamberlain
Frank M. Cole
Louise Cole
Dean Conine
James E. Cowan
Jeanne Dabney
Meade O. Davis, III
Tilton Davis, IV
Mrs. Dan Dillinger
A.W. Dowdy
Linda L. Fleming
Mark Fowden
Rober P. George
Paul H. Gertsch
Dennis O. and Lucille P. Gunnerson
Hayter Cattle Company
Robert W. Holmquist
Dale Hunt
Peter S. Illoway
Tom Jackson
Gerald N. Johnson
Rodney D. Johnson
Harold Josendal
Duane Keown
Thomas E. Kilty
Raymond Kunselman
John A. Larson
Robert A. Lee
Christopher D. Lidstone
Herrick K. Lidstone
M Cross Ranch, Katherine Moorehead

Burton W. Marston
Joseph B. Mattern
Leonard S. Mayer
Brien F. McAdams
Pat L. McGuire
R.C. Mead
Connie Meister
Joseph S. Meyer
Kenneth F. Nelson
Dale Oakes
Glenn Parker
Forest Payne
Donald and Helen Reed
J.D. Ritts
D.G. Roberts
Dave Rogers
Thomas Scavo
J.B. Spaulding
Howard L. Stanley
Joan Stout
Robert P. Vosseller
Archie and Midred Wheeler
Philip White
Marvin Wolf

C. RESPONDENTS TO THE REVISED DRAFT STATEMENT

Any individual or organization making written responses to the Revised Draft Environmental Impact Statement, "Cheyenne Stage II, Water Diversion Proposal", was included in the following list.

1. Federal Agencies

Advisory Council on Historic Preservation

Department of the Army:
-Omaha District, Corps of Engineers
-Bureau of Reclamation, Upper Colorado Regional Office
-U.S. Fish and Wildlife Service, Billings Area Office

Department of Commerce:
-General Counsel- Director of Regulatory Policy

Department of Interior:
-Office of the Secretary; Environmental Project Review

Environmental Protection Agency - Region VIII

Federal Energy Regulatory Commission

2. State Agencies

Colorado River Board of California
Geological Survey of Wyoming
Wyoming Department of Economic Planning of Development
Wyoming Department of Environmental Quality
Wyoming Game and Fish Department
Wyoming Recreation Commission
Wyoming State Engineers Office

3. County and Local Agencies

Casper Board of Public Utilities
Cheyenne Board of Public Utilities
Cheyenne Office of the City Council
Sweetwater County Board of Commissioners

4. Organizations

American Association of University Women
Cheyenne Chamber of Commerce
Friends of the Earth
Holiday River Expeditions
Maki-Mac River Expeditions
National Wildlife Federation -Natural Resource Clinic
Professional River Outfitters Association
Sierra Club, Wyoming Chapter
Western Ranchman Outfitters
Wild and Scenic, Inc.
Wyoming Outdoor Council
Wyoming Wildlife Federation, Southeast District

5. Elected Officials

Governor Edward Herschler
State of Wyoming

Honorable Russ Donley
Wyoming State Representative
Natrona County

Honorable Edward D. Moore
Wyoming State Senator
Converse County

Honorable Elizabeth Phelan
Wyoming State Representative
Laramie County

Honorable Walter C. Urbigkit, Jr.
Wyoming State Representative
Laramie County

6. Individuals and Others

Roger Abelson
Steve Andreas
James L. Applegate
Larry T. Atwell
Richard M. Baker
George T. Baxter
Christine Bertels

June Bishop
Larry Bressler
Andrew M. Bryson
Carla Capritta
Jennifer Christiaan
John C. Clay
O. D. Cochrun
Myra Connell
B. G. Dahlke
Randall L. Dancliff
Mead O. Davis
Stephen Davis
John E. Donohue
Michael Ehlers
Donald Ely
Robert E. Epp
Mike Evans
Jack N. Fassett
Donald W. Faussett
Walter C. Ferguson, III
Mark Fowden
John Freeman
Robert L. Gaukel
Elmes Garrett
Warren L. Gullett
Gary Hall
James R. Harnish
Judith A. Hart
Stanley K. Hathaway
Margaret Hayden
John Hayes
Harlan L. Hegler
James L. Higday
Lyle D. Hines
Norman Holmes
Virginia M. Holst
David Hyatt
Peter S. Illoway
Peter Iverson
Virginia Janes
Hugo Jensen
LeClercq L. Jones
J. P. and M. V. Johnson
Dr. John Johnson
Robert H. Johnson
Harold Josendal
Kim Keaten
Duane Keown
Kerry Brennan Kilty
Dale A. Kjack
Mrs. Harlan Knudson
Raymond Kunselman

Chris LaCroix
Richard LaCroix
Larry Lawton
Chris Lidstone
H. K. Lidstone
Edward M. Lonsdale
David Longnecker
Mr. and Mrs. Don MacDonald
Mr. and Mrs. Joseph McConaty
Jennie McDonald
Florence Posey Maguire
Joe Merrifield
Joseph S. Meyer
R. Walt Miller
Allen Morton
Bill Nation
A. B. Nelson
Shirley and Marinus Nielsen
Lee Nellis
Carman and Carl Neu
Sheila Nyhus
Larry and Rita O'Hayre
L. H. O'Hayre
Eileen Oldenburg
Mr. and Mrs. T. Osbourn and Family
Bob Owens
Darwin D. Pace
Steve and Marta Page
Lon C. Purdy
Tom Raines
Mr. and Mrs. Don Reed
Terry Reidy
Jim Richards
Robert Righter
E. L. Robison
Elsie Roepke
William Roepke
James D. Rose
James F. Ross
James P. Sheehan
W. K. Smith
Robert J. Sorensen
Mrs. C. M. Stafford
Howard Stanley
Margaret McCollin Struck
Ben Tammney
W. L. Throgmorton
Harley and Jewel Todd
Carl Trebler
J. D. Vandewark
Ruby VanSant
Robert P. Vosseller
Mrs. Charles Watts

Mr. and Mrs. W. E. West
Colonel W. L. West and Family
Jerry West and Family
June and Curtis Willis
Laurence J. Wolfe

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APPENDIX I

CONTENTS PAGE

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FOREST SERVICE
Medicine Bow National Forest
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JUN 1 1981

MAY 29 1981

IN REPLY REFER TO:
FA/SE/FS--Cheyenne
Water Supply Project

Craig Rupp, Regional Forester
Forest Service
P.O. Box 25127
Denver, CO 80225

Dear Mr. Rupp:

This biological opinion on stage II of the Cheyenne Water Supply Project (CWSP) is provided in response to your March 18, 1980, request and subsequent discussions and extensions of time between the U.S. Fish and Wildlife Service and the Forest Service, the Cheyenne Board of Public Utilities, and others. This opinion is submitted to you to conform to our agreement with the Cheyenne Board of Public Utilities as defined in a letter of April 17, 1981, from Under Secretary Donald Paul Hodel to Mr. Elmer Garret. That letter is attached, along with the resolution agreed upon by the Board, and made a part of this opinion. You will note that a determination as to whether the Cheyenne Water Project is likely to jeopardize the continued existence of the endangered fishes, and as to whether the Cheyenne Board of Public Utilities will need to carry out its commitment to financially participate in a recovery program will be issued no later than July 1, 1982. This determination will concern only the recovery aspects, not survival which is discussed in the body of this biological opinion. This biological opinion has been prepared as prescribed by the Section 7 Interagency Cooperation Regulations, 50 CFR 402, and the Endangered Species Act (ESA), 16 U.S.C. 1531 _et seq_.

BIOLOGICAL OPINION

Construction of stage II is not likely to jeopardize the continued existence of the Colorado squawfish (_Ptychocheilus lucius_), humpback chub (_Gila cypha_), or the bonytail chub (_Gila elegans_). Furthermore, the initiation of construction of stage II will not lead to an irreversible or irretrievable commitment of resources which would have the effect of foreclosing the formulation or implementation of reasonable and prudent alternative measures to preclude jeopardy (Section 7(d) of the Endangered Species Act, 16 U.S.C. 1536(d)). Due to the agreement by the City of Cheyenne to fund the recovery measures which may be needed to offset potential recovery impacts of stage II, as described below, the project will be able to proceed to completion.

Original - Medicine ...
cc: Pthinc.
WStmann
ZNHFF
RF

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These conclusions in the above paragraph are based on the Cheyenne Board of Public Utilities' agreement to fund the reasonable and prudent alternative that FWS has recommended, conservation measures not to exceed $180,000, in the event that determination is made that the ongoing studies show that the construction and operation of stage II is likely to jeopardize the recovery of endangered fishes. The $180,000 is based on a stage II potential average annual depletion of 21,000 acre-feet, and as agreed, if the depletion is less, the cost of the conservation measures will be adjusted accordingly. On April 20, 1981, the Board of Public Utilities of the City of Cheyenne by resolution approved such prospective funding. We are not reaching a determination as to whether or not the Project would appreciably reduce the likelihood of recovery of the species at this time because of insufficient information. The Colorado River and Tributaries Fishery Studies (described in the April 20, 1981 resolution of the Board as "FWS studies" and in the April 17, 1981 letter as "ongoing FWS studies") will provide sufficient information for us to determine, by July 1, 1982, if the conservation measures will not need to be funded to offset any stage II effects. The funding of the agreed upon conservation measures will not be necessary if the determination issued after completion of the studies concludes that the recovery of the species is not likely to be appreciably reduced without such measures.

In addition, the project is not likely to jeopardize the continued existence of the black-footed ferret (Mustela nigripes), the peregrine falcon (Falco peregrinus anatum), and the bald eagle (Haliaeetus leucocephalus).

PROJECT DESCRIPTION

In 1961, a water supply plan was prepared by J. T. Banner Associates for the City of Cheyenne, Wyoming. The plan provides for a long-range municipal water supply by diverting water from Douglas Creek, in the North Platte River drainage to the City of Cheyenne. Since all North Platte water is already appropriated, the plan calls for replacing diverted North Platte water with Colorado River water, which will be diverted from the headwaters of the North Fork of the Little Snake River, a tributary of the Yampa River, to the North Platte drainage via Hog Park Creek and the Encampment River. Development was planned in three stages to keep pace with the water needs of the City of Cheyenne. Stage I was completed in 1967 and has diverted an average of 7,400 acre-feet per year since 1961. For stage II, the City of Cheyenne requested 23,000 acre-feet per year. To provide instream water for trout, the Forest Service has suggested a reduction of this flow depletion for stage II to 19,500 acre-feet (Alternative B) or 15,800 acre-feet (Alternative C). Thus, according to the revised Draft Environmental Impact Statement (DEIS) issued May 4, 1981, the amount of the proposed depletions will be reduced by 3,500 acre-feet (Alternative B) and 7,200 acre-feet (Alternative C). Alternative C is favored by the Forest Service, thus, the remaining comments will deal with Alternative C of the DEIS.

BASIS FOR OPINION

To fully understand the basis for this biological opinion, as well as any other opinion on the Colorado fishes, it is necessary to understand the phrase "jeopardize the continued existence of." This is defined as an "activity or program which reasonably would be expected to reduce the reproduction, numbers, or distribution of a listed species to such an extent as to appreciably reduce the likelihood of the survival and recovery of that species in the wild." 50 CFR 402.02. (Emphasis added.)

Using the above definition of "jeopardy," the project was evaluated in two ways. (1) Would the project appreciably reduce the likelihood of survival of the species? (2) Would the project appreciably reduce the likelihood of recovery of the species?

To answer the first question, "would the project appreciably reduce the likelihood of survival of the species?", it was necessary to review and evaluate the endangered fishes and the physical changes occurring in endangered fishes' habitat due to the project water diversions.

The primary area of concern in this opinion is the Yampa River from its confluence with the Little Snake River downstream to the Green River, and the Green River from the mouth of the Yampa downstrean to its confluences with the White River and Duchesne River. These two reaches of river provide important habitat for the Colorado squawfish and the humpback chub. The habitat is also the type used by the bonytail chub but we do not know if it has been extirpated from the area. Due to their limited populations and the character of the environments inhabited by these native fishes, simple surveillance of their status is a major endeavor, and detailed life history studies are extremely difficult to accomplish.

The Colorado squawfish once was abundant throughout the Colorado River System. Now, the Upper Basin of the Colorado River has the last areas suitable for the squawfish. Holden and Stalnaker (1975-a) classified the Colorado squawfish as rare from above Lake Powell to above Grand Junction, Colorado, rare in the Green River from its confluence with the Colorado River to the mouth of the Yampa River, and rare in the Yampa River from its mouth to Craig, Colorado. They also found evidence that the then existing (1972) populations were declining, with reduced reproduction from 1968 to 1971. During his 4-year study, Holden took 300 adult squawfish from the Upper Basin and 261 (87 percent) from the lower Yampa River. Recent surveys (August 1980) have produced a squawfish at river mile 58 on the Yampa River (Williams 1980). Holden and Stalnaker (1969) have concluded:

> "The Yampa River is very important to the preservation of rare and endangered fishes in the Colorado basin primarily because all these rare forms (squawfish, humpback chub, bonytail chub, and razorback sucker) are at least present in small numbers and some are apparently reproducing. Perhaps the Yampa River is the most natural large river environment left in the Colorado basin."

Adult squawfish are usually found in large rivers, particularly eddies, pools, and protected pockets just outside the main current. Juveniles are usually found in small eddies and backwaters, typically 2 to 3 feet deep, and young-of-the-year prefer backwaters with silt or sandy bottoms. Gonads begin to mature in adults between April and June during spring runoff. Spawning begins in July or August when water temperatures remain above 21° C., no nest is prepared, and the adhesive eggs develop rapidly, hatching in less than 4 days.

Studies by Vanicek and Kramer (1969) suggest that high spring runoff stimulates maturation of reproductive organs in squawfish males. This stimulation by high runoff does occur in other fish species. Receding water levels may trigger mechanisms for spawning. Reduction of normal seasonal fluctuations may therefore hamper reproduction. Water depletions from the CWSP would occur during the high spring runoff and would lessen the fluctuation between high spring flows and lower summer flows. Depletions will not be large compared to average water flows, but the critical flow or degree of fluctuation required for successful reproduction is not known. Also the confluence of the Little Snake with the Yampa River at Lily Park, Colorado, is one of the few places in which squawfish are found regularly.

The humpback chub's original distribution included most of the larger swift-water canyons on the Colorado and Green Rivers above Lake Mead, and two Green River tributaries, the Yampa and White Rivers. However, the general impression is that during historical time, this species may never have been as common as other endemic fishes.

Humpback chubs were eliminated from the Green River above the mouth of the Yampa River in Colorado, Utah, and Wyoming when Flaming Gorge Dam became operational in 1962 (Vanicek et al. 1970). Humpback chubs were common in fishery samples from Lake Powell soon after closure in the 1960's, but they have not been collected during the last few years (personal communications, Dale Hepworth, Utah Division of Wildlife Resources). The cold tailwaters of Glen Canyon Dam (Lake Powell) have apparently caused major reductions in both distribution and abundance of humpback chubs in Marble and Grand Canyons (Minckley 1973; Holden and Stalnaker 1975a; Suttkus et al. 1976). Recent collections in the White River (anonymous 1977) and the Colorado River near Moab, Utah, (Taba et al. 1965; Holden and Stalnaker 1975a) have failed to find any humpback chubs. Humpback chubs were found in the lower Yampa River and the Green River within Dinosaur National Monument in studies from 1968 to 1971, and in the lower Yampa up to Lily Park in studies of 1975 and 1976 (Holden and Stalnaker 1975a; Seethaler et al. 1976). Recent samplings (August 1980) have produced one humpback chub at river mile 58 on the Yampa River (Williams 1980). This location was upstream from the mouth of the Little Snake River in Cross Mountain Canyon.

Humpback chub adults are usually collected in or adjacent to swift deep water. Young-of-the-year and juveniles prefer habitats with little current and shallower water depths than the adults. Little is known about reproduction of humpback chubs. Spawning generally occurs in mid-June to early July at water temperatures of approximately 18° C. (Suttkus and Clemmer 1977).

The bonytail chub was originally abundant in all the large rivers of the Colorado River Basin. They became rare and vanished from the lower basin between 1926 and the 1950's except for Lake Mohave, where only a small number of old adults have been collected. Sixty-seven bonytail chubs were collected in a study in Dinosaur National Monument during 1964 to 1966, but a study in the Monument from 1968 to 1971 found their numbers to be drastically reduced (Holden and Stalnaker 1975b). In a 1979 study by Holden and Crist (1980), 110 miles of Green River below Flaming Gorge Dam and 50 miles of the lower Yampa River were systematically sampled. Of a total of 23,245 fish handled, only one bonytail chub was identified. FWS cooperative studies have yielded only one adult bonytail chub in a sampling of an estimated 320 miles of the Green River and 292 miles of the Colorado and Gunnison Rivers in 1979. In this study over 35,000 fish were handled.

The bonytail chub is found in swift water canyon areas of large turbid rivers. It was generally collected in eddies adjacent to swift water (Vanicek 1967, Holden 1973). Little is known of the reproduction of bonytail chubs, except that, based on ripe fish, spawning probably occurs at approximately 18° C. (Vanicek and Kramer 1969).

In recent years, only the squawfish regularly has been collected in the lower reaches of the Yampa River; however, there are areas of the Yampa that appear to be ideal habitat for the bonytail and the humpback chubs. Partly because of the remoteness and rugged terrain of these canyon areas, our incomplete knowledge of the fishes' habits, and partly because the Yampa has not been investigated adequately, we cannot say that these fishes have been extirpated from the Yampa. Any populations that may continue to exist in the Yampa would be extremely important, given the drastic decline in occurrence of these fishes throughout their historic ranges (Holden and Stalnaker 1975b).

The Yampa is also important in providing water to the Green River to offset effects of major mainstream water impoundments and diversions, e.g. cold waters from Flaming Gorge. In an average year, the Yampa River provides approximately 49 percent of the water in the Green River as measured at Jensen, Utah. According to Holden (1980), the Yampa's influence is probably the reason that the Green River continues to support native fish populations.

The primary cause of decline for all these fishes is human alteration of the river environment. Major impoundments and water diversions have depleted water and altered temperature, turbidity, and stream flows, thus reducing required habitat. Another cause of decline, as reported by Vanicek and Kramer (1969), may be the increased number of exotic fishes, but this increase in exotics is also a product of habitat change.

Records of observations and collections over the years show that size and abundance of these fishes have been declining, as the Yampa and its tributaries have been subjected to a multitude of small municipal, industrial, and irrigation withdrawals. Even though no major projects have been constructed, the habitat still has degraded. However, the Yampa is the last "large river" in the Colorado drainage without a major impoundment and still contains the type of habitat important for squawfish and endangered chubs. Researchers emphasize that the specific habitat needs of the native fishes are incompletely understood. Their high degree of endemism suggests that they thrive on only a very narrow range of habitat conditions and only slight modifications of the environment affect them adversely.

Flow depletions have immediate and long-term effects. Immediate effects are those brought about by the reduction of stream size so that fish can no longer find required habitat, in particular, backwaters for breeding. Depleting flow below the critical level would result in loss of the endangered fish populations. The precise level considered critical for these species has not yet been determined, and studies are ongoing to develop this information

Long-term effects of flow reduction include the parallel changes in stream mechanics which in turn alter stream bank cutting, meander patterns, backwater building, sediment transport capacities, and velocities. With time, eddies, pools, riffles, river banks, and river beds, along with depth, width, and flow pattern can be greatly altered. These changes plus subtle changes in factors such as temperature, turbidity, and ion balance may adversely affect the reproduction, behavior, and sensitive life stages of the endangered fishes.

Based on flow estimates of the Yampa River at the confluence of the Little Snake River, stage II of the project will have the following effects on the Yampa River:

1. The mean annual flow of 1,523,000 acre-feet will be reduced by 1.0 percent (Alternative C).

2. The representative low flow (1963) of 833,600 acre-feet would be reduced by 1.9 percent (Alternative C).

3. The representative high flow (1971) of 2,112,600 acre-feet would be reduced by .8 percent (Alternative C).

An analysis of the potential effects of stage II was prepared by the Instream Flow Group (IFG), Western Energy and Land Use Team in Fort Collins. IFG looked at both flows and sediment in the Yampa River below the confluence of the Little Snake River and their relationships to the Colorado squawfish. IFG determined that no significant changes in the depth and sizes of backwaters (young-of-the-year habitat) would occur as a result of stage II of this project, by itself. Actual changes were estimated at 1 to 2 percent or less.

In short, it is reasonably expected that the impacts of the project on the likelihood of survival are extremely small. Therefore, we conclude that stage II of the Cheyenne Water Supply Project is not reasonably expected to appreciably reduce the likelihood of survival of the endangered fishes of concern.

Since the status of the fish can be related to decreased flows in the basin, additional water use is likely to make recovery of the species more difficult. We believe that the conservation and recovery measures discussed in the next section of the biological opinion will aid in the recovery of the fishes. We will have sufficient information to determine if stage II is likely to impact the recovery of the endangered fishes after completion of the fishery studies in 1982.

In order to obtain needed information, a Colorado River Fisheries Investigation Team was established in April 1979 to conduct studies in the Upper Colorado River Basin. From these studies, specific life history requirements of the listed fishes will be acquired. An additional component of these studies is being initiated on the Yampa River which will complement the Green and Colorado Rivers studies. In addition, Bio/West Incorporated, Logan, Utah, is studying effects of modifying the penstock of the Flaming Gorge Dam. These efforts will generate data not now available, from which specific recommendations can be developed which will produce and maintain a more favorable habitat for the listed fishes in the Colorado River Basin. The information will also aid us in developing recommendations for the fishes in the Yampa River and other major tributaries.

The Board of Public Utilities for the City of Cheyenne has agreed to participate in a plan for the conservation of the fish species, not to exceed $180,000, if, based on the studies, we conclude in 1982, that the project is likely to appreciably reduce the likelihood of recovery of the species in the wild. Since the Board, by resolution, has agreed to fund a portion of the conservation plan and such funding is the reasonable and prudent alternative recommended if a determination is made that the project would appreciably reduce the likelihood of recovery of the species, we conclude that the initiation of construction of stage II of the project is not likely to jeopardize the continued existence of the species. Furthermore, because of the Board of Public Utilities's resolution, FWS concludes that initiation of construction on stage II would not violate Section 7(d)'s prohibition of irretrievable or irreversible

commitment of resources. Due to the agreement by the City of Cheyenne to fund the recovery measures which may be needed to offset the potential recovery impacts of stage II, the project will be able to proceed to completion.

CONSERVATION MEASURES TO AID IN THE RECOVERY OF THE ENDANGERED FISHES

The conservation measures, to which the City has agreed to contribute its financial share unless their project is found not to impact recovery of the fishes, may include but not be limited to:

FLOWS

The importance of flow releases or bypasses cannot be overemphasized. This could involve the purchase of water rights for the fish or the release of water from existing projects. As discussed in the project description, Alternative C would bypass 7,200 acre-feet. This instream flow is for trout habitat, but it also will benefit endangered species downriver. These bypass figures will certainly be considered in the final determination.

HABITAT MANIPULATION

Habitat manipulation may also be an important part of an overall conservation program for these fishes. Attempts to create young squawfish rearing habitat could be made. Such actions could include gravel placement for fish spawning, creation of still water areas for rearing by excavation or placement of large boulders, or manipulations that could alter velocities, depths, or substrate in the backwater areas.

MONITORING AND RESEARCH

Monitoring and continued research is definitely needed in the basin. This could include intensive studies to examine backwater areas in the basin in an attempt to determine the value of these areas as nursery habitat for young squawfish. Water velocities, depth, quality, and other parameters need to be determined for backwater areas being used by squawfish. More research on spawning habitat requirements for the endangered fishes are needed to learn the extent to which such habitats are a major limiting factor for recovery of the species.

FISH CULTURE

Fish culture should not be thought of as a conservation program in itself because the Endangered Species Act sets forth the need to conserve natural ecosystems. Periodic stocking of fish in the Colorado River system could be a legitimate way to alleviate some problems now encountered by the fishes. We suspect that habitat problems associated with reproduction

and early life stage have caused these fish to decline over the past few years. If this proves to be the case, then a conservation program with fish culture and stocking may play a part in recovery and delisting of these species.

OTHER SPECIES

The Forest Service's Biological Assessment of August 31, 1979, concluded that the project "would not significantly affect" any of the listed species that may occur in the area. It specifically addressed the endangered fishes and included general references on the black-footed ferret, and peregrine falcon. There was no reference to the bald eagle, which had been included in the species list transmitted by the Fish and Wildlife Service on March 14, 1979.

In our letter of January 25, 1980, we requested that the revised biological assessment consider all species that may be affected by the CWSP. In the supplement to the biological assessment, the Forest Service determined that the CWSP would not affect other listed species.

We concur in this determination. Wintering bald eagles use the project area and the area affected by water withdrawals, and there is a nest on the Little Snake River in Colorado. But, there will be no effect on these eagles from the project.

One peregrine was seen in 1974 near the mouth of Douglas Creek, but there is no evidence of any other occurrence in the area.

Most of the project will be constructed at altitudes above those at which prairie dogs occur; therefore, the project will have no effect on the black-footed ferret, which depends upon prairie dogs for its existence.

Should there be any change in the project as proposed prior to the final agency action which may affect any threatened or endangered species, or if any new species are listed as threatened or endangered, the FWS should be contacted to determine if further consultation is required.

Sincerely yours,

Don W. Minnich

Don W. Minnich
Regional Director

Attachment

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HE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

State Engineer's Office

BARRETT BUILDING CHEYENNE, WYOMING 82002

August 13, 1981

Mr. Don M. Bolinger
Project Coordinator
Medicine Bow National Forest
605 Skyline Drive
Laramie, Wyoming 82070

Dear Don:

In response to your inquiry about a reply to comments from Robert H. Johnson and John L. Yerkovich on Stage II of the Cheyenne Project, I submit the following. Both letters express similar concerns, including loss of the potential use of water from the main stem of the Green River and a perceived need for a hearing on the project in Rock Springs.

The Little Snake River is a part of the Colorado River system and is subject to the 1922 Compact, the 1944 Treaty with Mexico, and the 1948 Compact apportioning the Upper Basin's share of water among the States of the Upper Basin, as well as applicable court decisions and Federal laws and regulations. The system is also subject to the body of law of each State contributing water to the system.

Strictly speaking, Wyoming is not obligated to deliver a given quantity of water downstream each year. The Upper Basin, under the 1922 Compact, is required to deliver at Lee Ferry, Arizona, 75 million acre-feet of water in any consecutive ten-year period. The annual delivery quantities may vary, so long as the ten-year quantities are met. As a part of the Upper Basin, Wyoming is a party to meeting this committment, but not with a specified quantity. Article IV of the 1948 Compact sets forth the principles upon which each State's contribution toward meeting any shortage will be based.

The Colorado River Storage Project (CRSP) has been developed in the Upper Basin to store water for meeting delivery shortages to the Lower Basin when they occur. The intent is to avoid, or at least keep to a minimum, any curtailment of water use in the Upper Basin that is within the provisions of the compacts. In addition, power revenues from the six CRSP dams are used to assist the Upper Basin States in developing their portions of the Upper Basin's water.

Deliveries to Mexico under the 1944 Treaty could also affect the compacted water uses. Davis Dam has been constructed in the Lower Basin to provide water when necessary to meet this delivery in low flow years.

Regulation of water depletions in Wyoming to meet compact and treaty deliveries is not likely except in times of severe and prolonged droughts. Under such conditions, State water rights would also be heavily regulated even without the compact deliveries, except in those states where storage has been provided to alleviate water shortage problems. Developments that exceed Wyoming's compact allotment can expect to be curtailed in times of shortage.

"Thus, any amount of water diverted from the Little Snake River must be made up, gallon for gallon, from the Green River in Wyoming." This is the last sentence of the third paragraph of Mr. Johnson's letter and, as expressed, it is open to debate. The water need not be "made up" in the sense that it must be replaced, or moved, to the Little Snake River. Water diverted and consumed from <u>any</u> stream in the Green River Basin in Wyoming for beneficial consumptive use will be charged against the compact water allotted to the State whether the use is in-basin or out-of-basin. Depletion of water from one stream means that the future depletion of a corresponding quantity from any of the other streams must be foregone. The converse of Mr. Johnson's statement is equally true. A quantity of water depleted from the Green River precludes the depletion of that quantity from the other streams, including the Little Snake River.

Depletion of water from the Little Snake River should not have any adverse effect on Green River water rights in Wyoming. There is no physical connection in Wyoming between the rivers and the relative water rights between them are not pertinent. In fact, as noted above, depletions from the Little Snake River would reduce the future quantity that could be depleted from the other rivers, including the Green. Water would have to remain in these other rivers, and would help meet the needs of existing rights as well as the instream flows the Green River area people have considered so important.

The shortages that were felt in 1977 were to water rights that did not have a provision for stored water to alleviate shortages in times of reduced streamflow. I am not aware of shortages below Fontenelle Reservoir to those rights senior to the reservoir or that had reservoir storage, or to junior rights in that reach of the river. Without stored water as a back-up, any direct flow water right is subject to the flow rate of the stream and the priority ranking of the water right.

Most of Wyoming's natural streamflow occurs in two or three months during the snowmelt season. Unless these flows can be stored for use throughout the year as needed, direct flow water rights can expect shortages from time to time, and the more junior the right, the more frequent and prolonged will be the shortage. Without more storage on the Green River and the Little Snake River, future development of water uses that require firm water supplies is limited and should not even approach the water allotted to Wyoming. Storage can also be developed by industrial users and municipalities outside of the river channels, if they have diversion works of sufficient capacity to utilize the high runoff to fill the storage (and the necessary water rights to do so).

The amount of water available annually to Wyoming is as yet uncertain. Estimates give a low figure of 805,000 acre-feet, which the State believes to be significantly too low, and a high figure of 1,043,000 acre-feet, which is available to the Upper Basin. If the present and committed depletions are deducted, the estimated range of remaining annual compact water is 161,500 to 399,500 acre-feet. Water would still be available in the Little Snake River for about 78,600 acre-feet of depletion from the remaining compact allotted water.

Mr. Yerkovich's second paragraph is similar to Mr. Johnson's third paragraph, addressed above. As a further point on the subject of depletion from the Little Snake River vs. depletion from the Green River, the water is the property of the State and its use, subject to the laws of the State, is available in priority to those individuals or other entities who appropriate it and put it to beneficial use.

The question of the effects of Little Snake River depletions on the Green River area was addressed above. Briefly, "studies" would show that a depletion from the Little Snake River would reduce the total amount of compact water remaining for use in the State, no matter which Green River Basin streams the remaining depletions would be drawn from. The "effects" on the area would be possibly foregoing an increment of development requiring the consumptive use of water.

Numerous studies have been made of water availability and water use in the Green River Basin. The Wyoming Water Planning Program published "Water & Related Land Resources of the Green River Basin, Wyoming" in September 1970 (now out of print). This was summarized in the "Wyoming Framework Water Plan", 1973, copies of which are available from the Wyoming Water Development Commission. The USDA published the "Green River Basin, Wyoming, Cooperative River Basin Study" in September, 1978. The USBR published a Status Report on the "Sublette Project Investigations" in February, 1980. There have been other Federal, State and private studies made, and in-house work has been done by my staff and by the Wyoming Water Development Commission. People from the Green River Basin

were involved in the cited USDA and USBR studies. The essence of the studies is that there is water available for future consumptive uses, and that storage is needed to utilize this water effectively.

A final point: The two Colorado River Compacts are based on depletion. Depletion of streamflow occurs through in-basin beneficial consumptive use through irrigation, a variety of industrial uses, municipal use, etc., and through export to another basin for beneficial use. The effect of an export to another river basin is exactly the same, hydrologically, as if the depletion was through evaporative cooling in a power plant or through crop consumptive use.

I hope all of this is helpful to you. Please call if you have further questions.

Sincerely,

George L. Christopulos

GEORGE L. CHRISTOPULOS
State Engineer

GLC/ht

cc: Louis E. Allen
Water Resources Engineer

July 31, 1981
LEA

DISCUSSION OF THE COLORADO RIVER SITUATION AS IT PERTAINS TO WYOMING'S COMPACTED WATER USE.

The discussion was prepared as a summary of the Colorado River regulatory situation and particularly to examine Wyoming's allotted water use under the Compacts, the Treaty with Mexico, and other constraints. Hopefully, it will provide a concise reference to address many questions that continue to arise. The uncertainties involved in arriving at firm figures for the beneficial consumptive use of water both present and future are noted, as are some of the physical limitations to full use of the compact water.

The Constitution of the State of Wyoming declares the waters of the State are the property of the State, and provides for the administration of those waters by the State. The Wyoming Statutes provide for the use of the State's waters under the appropriation doctrine of law whereby the earliest appropriator of water for beneficial use has the best right to its use. Water appropriation does not convey water ownership, only the ownership of a right to the beneficial use of a specified water flow rate or of a specified volume of stored water, subject to the laws of the State and the physical availability of water to the water right.

The 1922 Colorado River Compact divided the flow of the river between the Upper Basin and the Lower Basin, with the intent to allow 7.5 million acre-feet of annual consumptive use in each portion. A delivery by the Upper Basin of 75 million acre-feet in any consecutive ten-year period at Lee Ferry, Arizona, is required. Hydrologically, the Upper Basin may not be able to consumptively use its allotted 7.5 million acre-feet and still deliver the ten-year 75 million acre-feet required, since the long term average annual flow at Lee Ferry appears to be less than the 15 million acre-feet or more anticipated at the time of the Compact.

The Upper Colorado River Basin Compact of 1948 apportioned the water allocated to the Upper Basin under the 1922 Compact among the States of

the Upper Basin. Wyoming is to receive the consumptive use of 14 percent of the Upper Basin water, after deducting 50,000 acre-feet apportioned to Arizona for its Upper Basin drainage. The apportionment refers to man-made depletions and is restricted to beneficial uses. The Compact also apportions the waters of the Little Snake River between Wyoming and Colorado, and the waters of Henrys Fork between Wyoming and Utah.

A Treaty between the United States and Mexico (1944) includes the Colorado River. This basically requires the annual delivery of a minimum of 1.5 million acre-feet to Mexico. The obligations of the United States under this Treaty are protected in the Upper Colorado River Basin Compact of 1948. Court decisions and Federal legislation add to the constraints of the Colorado River operation.

The question of how much water Wyoming is entitled to consume from the system is not fully answerable at this time. The uncertainties include the long-term average annual flow of the river at Lee Ferry, corrected for depletions. There are uncertainties and estimations in calculating this virgin flow. The average annual flow is apparently less than the 15 million plus acre-feet anticipated when the 1922 Compact was drafted. The 1.5 million acre-feet delivery to Mexico is an obligation of the United States, but if there are less than 16.5 million acre-feet of average annual flow in the system, there may be a shortage to the Upper Basin Compact approtionments. How any shortage will be borne has not been adequately defined, beyond the delivery of 75 million acre-feet to the Lower Basin in any consecutive ten-year period. The unresolved questions of Federal reserved rights, Indian reserved rights, and who is to be charged with water wasted in order to meet salinity reduction demands further complicate the issue. For water available to future uses, there are uncertainties in the estimations of actual depletions, particularly reservoir and stock pond evaporation and irrigation consumptive use.

The Colroado River Storage Project (CRSP) has as one of its purposes the provision of storage in above-average flow years to meet the required delivery to the Lower Basin of 75 million acre-feet in any consecutive 10-year period. The CRSP consists of four units and a total of six reservoirs:

Lake Powell, Flaming Gorge, Navajo, Blue Mesa, Morrow Point, and Crystal. These reservoirs have a combined storage capacity of nearly 34 million acre-feet. Power revenues from the CRSP are shared by the Upper Basin States to help with the development of the water apportioned to the States. CRSP reservoir evaporation is also proportioned among the Upper Basin States as a part of the Upper Basin depletions of the Colorado River.

Davis Dam has been constructed as part of the Parker-Davis Project in the Lower Basin for the purpose of storing water to meet the 1.5 million acre-feet annual delivery required under the Treaty with Mexico. The reservoir, Lake Mohave, has an active capacity of 1,810,000 acre-feet.

With the storage provided by the CRSP for protection of the 1922 Compact delivery to the Lower Basin, and by Lake Mohave for protecting the delivery to Mexico required by the 1944 Treaty with Mexico, the Upper Basin States should not often be restricted in their Compact water uses. The States should, however, consider the long-term average annual virgin flow at Lee Ferry in determining their compacted depletions. Depletions based on this amount should not be curtailed except in times of severe and prolonged droughts.

Estimates of the total depletion of the system apportioned to Wyoming, 14 percent of the Upper Basin apportionment, range from 805,000 acre-feet to 1,043,000 acre-feet, depending upon the definitions, interpretations, and combinations of the above uncertainties. While the larger figure may not be realized due to the hydrologic situation, the State believes the amount may exceed the lower estimate by a significant amount.

There are about 445,400 acre-feet per year of surface water now being consumed in Wyoming from the Colorado River system. This depletion can be broken down as shown in Table I.

TABLE I

1981 Green River Basin Depletions in Wyoming*

Use	1981 Depletion (Ac-Ft)	Percent of 1981 Depletion	Percent of 805,000 Acre-Feet
Irrigation	254,700	57.2	31.6
Industrial	70,100	15.7	8.7
Municipal and Domestic, in-basin	4,400	1.0	0.5
Cheyenne Stage I Diversion	7,200	1.6	0.9
Livestock and Wildlife	8,500	1.9	1.1
In-basin Reservoir Evaporation	27,500	6.2	3.4
Wyo. Share of CRSP Evaporation	73,000	16.4	9.1
	445,400	100.0	55.3

*Based on an anlysis by the Wyoming Water Development Commission (WWDC) Staff, April 1981.

The depletions shown in Table I are from all of the Green River drainage - the Green River and tributaries above Flaming Gorge Reservoir; Blacks Fork and its tributaries, including Hams Fork; Henrys Fork and its tributaries; and the Little Snake River and its tributaries.

A summary display of Compact water available to Wyoming and its reduction by present level uses (1981) and committed uses, with remaining water available after each reduction, is given in Table II. Many of the entries in this table are, of necessity, estimates. There is room for disagreement in defining "committed". The "A" section of Table II shows between 161,500 and 399,500 acre-feet of depletion remaining to the State after present and committed basin-wide depletions are accounted for. The "B" section considers only the Little Snake River, with 78,600 acre-feet of potential depletion remaining after accounting for present and committed

TABLE II

Compact Analysis, Green River and Little Snake River Basins*

All units are acre feet

	Depletions	Little Snake River Water Available	Compact Depletion Allotted to Wyoming Low Est.	Compact Depletion Allotted to Wyoming High Est.
A. Available for Wyo. depletion			805,000	1,043,000
1981 Depletions (from Table I)	445,400			
Remaining depletion for Wyo.			359,600	597,600
Committed uses:				
Exclusive of Little Snake River, estimated	100,000			
Little Snake River (see below), estimated	98,100			
Total committed depletion	198,100			
Remaining depletion for Wyo.			161,500	399,500
B. Little Snake River, remaining flow depletable by Wyo.		176,700		
Committed Little Snake River uses:				
Irrigation, permitted, undeveloped	20,100			
Stage II, estimate	20,500			
Stage III, estimate	30,000			
New reservoir yield, estimate	27,500			
Total Little Snake River committed depletion	98,100			
Remaining available for Little Snake River depletion		78,600		
C. Remaining for compact depletion from Green River, Blacks Fork, and Henrys Fork, assuming that the remaining Little Snake River compact water (78,600 ac-ft) is developed from the Little Snake River			82,900	320,900

*Adapted from an analysis by the WWDC Staff, April 1981.

depletions. The "C" section shows between 82,900 and 320,900 acre-feet of potential depletion for the rest of the basin if all of the 78,600 acre-feet of depletion remaining to the Little Snake River was developed from the Little Snake River.

The potential depletion remaining for Wyoming use, 161,500 to 399,500 acre-feet, can be developed from any of the streams where sufficient unappropriated water is physically available. The key to how and where it is to be developed lies in the water rights system for appropriation of water for beneficial consumptive use. Apart from a portion of the Green River main stem under the provisions of the 1974 Fontenelle Contract, there are no restrictions upon where water can be diverted from the streams. "First in time is first in right" for appropriation of water. In reality, considering water availability, most of the remaining uncommitted Compact water (Table II,Section C) will probably be developed from the Green River. Much of the remaining 78,600 acre-feet of uncommitted Little Snake River depletion will likely be developed from that basin. If not, it will be lost to Wyoming use and the demand to meet water needs will fall on the remaining streams in the Green River Basin. The depletion of water from a given stream will obviously reduce the remaining Compact water, and the depletion of that amount from the other streams will be foregone.

Only a limited amount of future water needs can be met in the Basin without further storage development. Some storage space in Fontenelle Reservoir is still available for purchase. The reservoir has 190,250 acre-feet of designated active storage, but due to the "as built" rip-rap situation, only about 154,000 acre-feet of the active storage can be utilized. The bulk of the runoff in the basin coincides with the spring snow melt and, except for two or three months, the flows are relatively low for the remainder of the year. Unless storage space is available to capture water during the high flow period, future industrial and other uses requiring a steady supply are precluded. Most of the irrigation potential for large users has been developed, and future developments would require storage to be effective.

Stages I, II, and III of the Cheyenne Project incorporate storage, although it is out of the basin. The Stage III concept has been expanded

to include storage in the Little Snake River basin for in-basin uses. Proposals for major additional storage in the Green River Basin have not been acceptable to the general public. Fontenelle Reservoir, even if all 190,250 acre-feet of active storage space was available, could not have much impact on the roughly one million acre-feet annual flow in the Green River. The uncaptured Green River runoff can only flow out of the State and be lost to Wyoming use, unless storage space can be acquired in Flaming Gorge Reservoir and the water pumped back to its place of use. This approach appears to be uncertain at this time.

APPENDIX II

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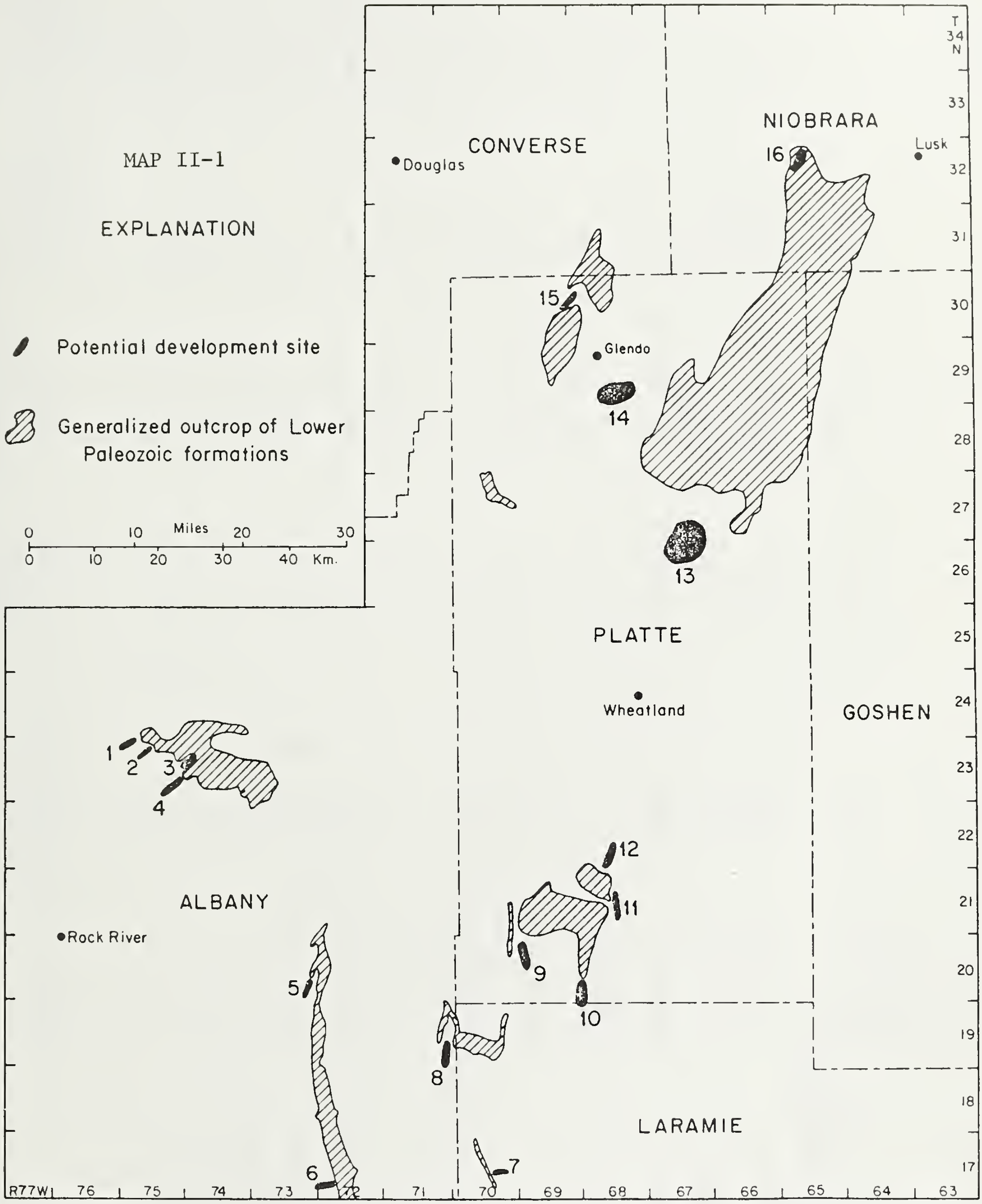
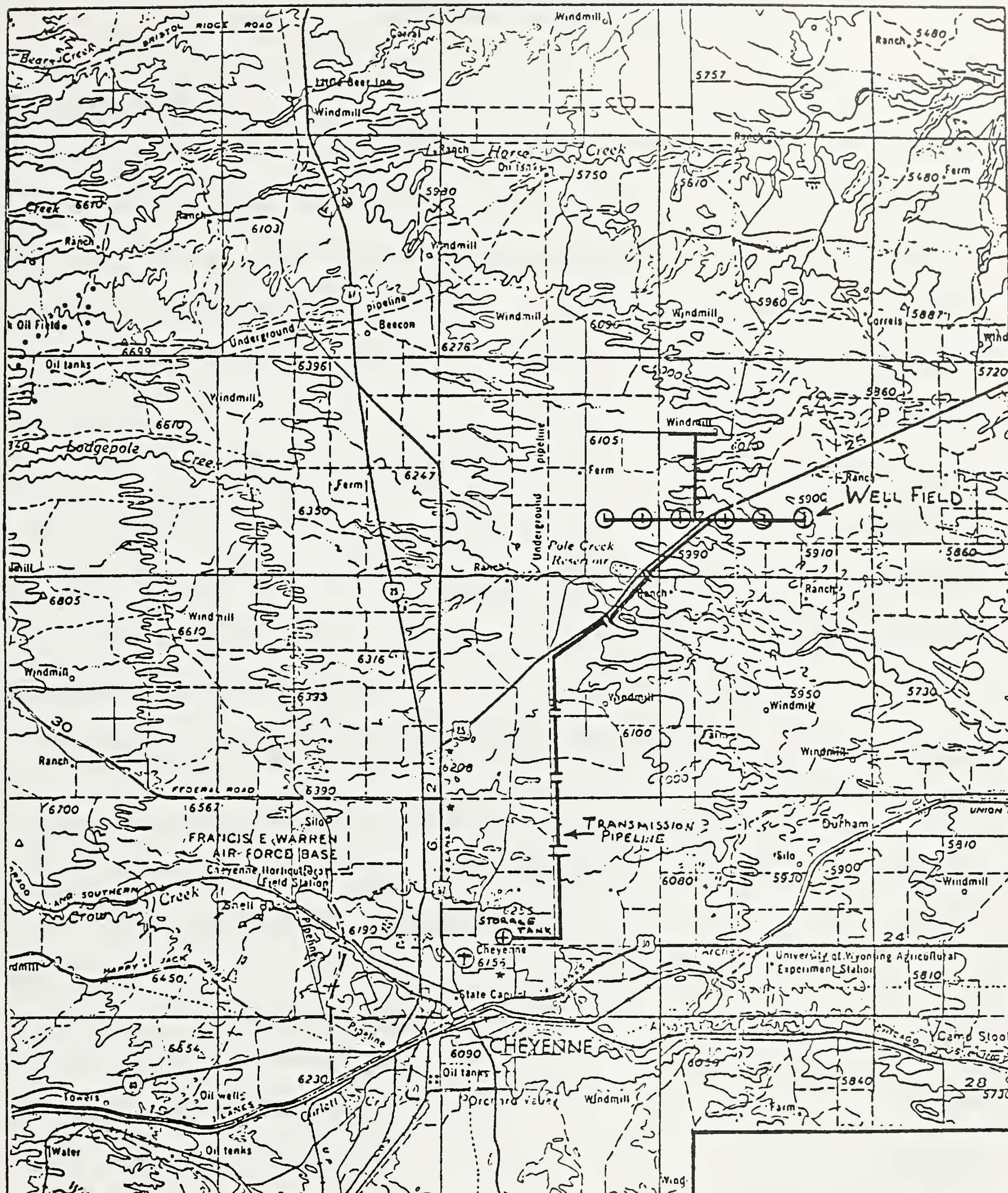


Location of potential ground-water development sites.

Site[1]	Location (T/R-Sec)	Thickness of Saturated Section (ft)	Depth to Static Water Level (ft)	Drilling Depth to top of Aquifer (ft)	Development of Fracture Permeability	Development of Sandstone Permeability	Rank
LARAMIE BASIN							
1. Como Fault	23/75-5,6	500	200	200-1000	good	good	1
2. True Ranch Syncline	23/75-9	500	200	200-1000	moderate	good	5
3. Seven Mile Crk. Area	23/74-18	500	200	200-1000	good	good	4
4. Gillespie Anticline	23/75-24,25,26	500	200	200-500	good	good	2
5. Sybille Spgs. Syncline	20/73-25,35,36	600	50	50-700	good	moderate	3
6. Red Hills Fault	17/72-29,30	500	100	100-700	moderate	moderate	6
EAST OF LARAMIE MOUNTAINS AND RICHEAU HILLS							
7. Horse Creek	17/70-23	1100	50	?	good	poor	3
8. Iron Mtn. Syncline	19/71-24,25,36	1100	50	1900-2500	good	poor	1
9. Deadhead Crk. Syncline	20/69-25,36 20/68-30,31	?	?	800-2000	good	poor	4
10. McDonald Ranch Monocline	20/69-25,36	1000	100	400-2000	good	poor	2
11. Diamond Ranch Monocline	21/68-15/22	1000	200	?	moderate	poor	6
12. Irvine Ranch Syncline	22/68-28/33	1000	50	50-500	moderate	poor	5
HARTVILLE HILLS AND GLENDO AREA							
13. Broom Crk. Syncline Area	26/67-1-4, 9-11, 14-16 27/67-25-28, 33-35	850	400	1000-1500	unknown	good	1
14. Horshoe Creek Area	29/68-26-28,	950	50	300-1200	poor	good	2
15. Elkhorn Anticline	30/69-12,13,14	900	50	50	good	poor	3
16. Manville Fault Zone	32/65-9,16	500	100	100	good	poor	4

1/ Numbers correspond to areas identified on Map II-1 and discussion in text; most names are informal.



Map II-2

CHEYENNE WATER PROJECT
FEASIBILITY STUDY

Water Resources Research Institute
(WRRI), 1979

LARAMIE COUNTY GROUNDWATER DEVELOPMENT COSTS

CONSTRUCTION COSTS	
Wells, pumps, and interconnecting pipelines	$ 907,000
Pipeline (wellfield to Cheyenne)	4,036,000
Pumping plants and attendant facilities (one)	270,000
Electrical transmission lines	114,000
Water rights and right-of-way	1,016,000
Subtotal	$ 6,343,000
Contingencies (15 percent)	951,000
Subtotal	$ 7,294,000
Engineering and legal (9 percent)	656,000
TOTAL CAPITAL COST	$ 7,950,000
OPERATION AND MAINTENANCE COSTS	
Wellfield, pipeline, and pumping plant operation and maintenance	$ 40,000
Electrical energy for wells (4¢/KWH)	94,000
Electrical energy for pumping plants (4¢/KWH)	126,000
TOTAL OPERATION AND MAINTENANCE COST	$ 260,000
ANNUAL COSTS	
Amortization of Capital Cost (7 percent - 40 years)	$ 596,000
Operation and maintenance	40,000
Electrical energy	220,000
TOTAL ANNUAL COST	$ 856,000

CASPER FORMATION GROUNDWATER
DEVELOPMENT COSTS

CONSTRUCTION COSTS	
Wells, pumps, and interconnecting pipelines	$ 2,730,000
Pipeline (wellfield to Middle Crow Creek)	10,017,000
Pumping plants and attendant facilities (two)	1,152,000
Electrical transmission lines	458,000
Water rights and right-of-way	2,900,000
Subtotal	$17,257,000
Contingencies (15 percent)	2,589,000
Subtotal	$19,846,000
Engineering and legal (9 percent)	1,786,000
TOTAL CAPITAL COST	$21,632,000
OPERATION AND MAINTENANCE COSTS	
Wellfield, pipeline, and pumping plant operation and maintenance	$ 73,000
Electrical energy for wells (4¢/KWH)	151,000
Electrical energy for pumping plants (4¢/KWH)	608,000
TOTAL OPERATION AND MAINTENANCE COST	$ 832,000
ANNUAL COSTS	
Amortization of Capital Cost (7 percent - 40 years)	$ 1,623,000
Operation and Maintenance	73,000
Electrical Energy	759,000
TOTAL ANNUAL COST	$ 2,455,000

Table II

Common Water Savings Devices - Their Effectiveness/Cost 1/

	Water Savings gpcpd	Reduction in Household Water Use (%)[a]	"Approximate" Additional Cost[b]	Remarks
Flow Control Devices - Faucets				
Kitchen Sink	0.5	0.8	65¢ to $5 ea[c]	Installed on kitchen sink hot and cold water. 2½ gpm flow rate
Lavatory	0.5	0.8	65¢ to $5 ea[c]	Installed on bathroom lavatory hot and cold water. 2½ gpm flow rate
Aerators	0.5	8.8	$1 ea	Installed on kitchen sink and lavatory faucets.
Insulation of Hot Water Pipes	2.0	3.0	50¢/ft	Slit foam tubing.
Flow Control Devices-Showers:				
Flow Control Head or "In-Line" Fitting	7.5	12.0	65¢ to $5 ea[c]	3 gpm flow rate
Thermostat Mixing Valve	2	3.0	$24 ea	Installed on kitchen sink and shower/bath.
Reduced Water Toilet Devices:				
Shallow Trap Toilet	7.5	12.0	$13 ea	Based on water requirement of 3½ gallons per flush.
Flush Valve Toilets	7.5	12.0	-	
Toilet Dam	5	8.0	$6 ea	Savings higher with some toilets.
Displacement Bottles	2.5	4.0	20¢ ea	2 1-qt. bottles displacing ½ gal/flush
Specialty Systems:				
Minuse Shower	14	22.0	-	
Vacuum Flush Toilet	22.5	35.0	-	
Compressed Air Toilet	25	39.0	-	

a Household water use taken as 64 gpcpd (excludes outside irrigation).

b Materials only and based on cost over and above "normal" practice. Prices should be considered as "ball park" estimates only.

c Price varies depending on materials. Low value is for plastic insert. High value is for chrome plated brass fittings.

1/ North Merin County Water District, 1977, North Merin's Little Compendium of Water Saving Ideas

Table II-5. Estimates of the Cost of Recycled Water in a 100 MGD Facility (Potable Water)[1]

	Denver		Water Factory 21	Dallas		San Diego		Smith	
	(1)	(2)		(A)	(B)	(A)	(B)	(1)	(2)
Lime treatment	x	x	x	x	x	x	x	x	x
Selective ion exchange	x	x				x	x	x	
Carbon Absorption	x	x	x	x	x			x	
Ozonation	x	x			x				
Reverse Osmosis	x	x				x	x		x
Chlorination	x	x	x					x	x
Nitrification						x	x	x	
Filtration									
Pressure	x	x							
Mixed media			x	x	x	x	x	x	x
Recarbonation									
single stage	x								
two stage		x	x						
COST PER THOUSAND GALLONS (in dollars) TREATMENT ONLY	1.64	1.22	1.58	0.70	1.04	1.65	1.75	1.29	1.29
COST PER THOUSAND GALLONS INCLUDING $0.20 TRANSMISSION	1.84	1.42	1.78	0.90	1.24	1.86	1.95	1.49	1.49

Notes: Denver (1) is the estimate of the cost of recycled water for a 100 mgd plant based on the treatment train of the Denver demonstration plant of Figure 3-1. Denver (2) is the Work and Hobbs estimate published in 1976 for a large scale Denver system. The Dallas and San Diego estimates are those of Clark, Gillean, and Adams mentioned in the text of this chapter. Smith (1) and (2) refer to the first and second Smith process analyzed. Cost differences result from both pricing differences and differing processes recommended.

1/ Morris and Jones, 1980, Water for Denver, Analysis of the Alternative.

ELMER GARRETT, PRESIDENT
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Board of Public Utilities

Cheyenne Water and Sewer Departments

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AREA CODE 307: 637-6460

June 23, 1981

Don Bolinger, Project Coordinator
U.S. Forest Service
605 Skyline Drive
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RE: Written Response to the Revised Draft E.I.S. on Cheyenne's Stage Two Water Project.

Dear Don:

Enclosed are corrected tables for the R.D.E.I.S. The report makes many references to average daily per capita use for various years, however, there is no consistancy in the way the figures for the gallons per capita day water use have been calculated. On page II-65 a historical use pattern is presented. It stops with the year 1976. I have updated the table to 1980 and I have adjusted the populations between 1970 and 1980 to be compatible with the 1970 and 1980 census figures. The Column "Total Water Use MGD" is the total water supplied to the Cheyenne service area as measured by the 5 large meters on the supply mains west of Cheyenne. The column "Cheyenne Urban Industrial Demand MGD" is the total of the industrial class users plus Warren Air Force Base, for each year listed. Any different breakdown of data is not available prior to the year 1976. The column "Domestic Water Use MGD" is the Total minus the Urban industrial. This would be a total of all other water use such as residential homes, commercial, parks, cemetaries, green ways, golf courses and the South Cheyenne Water District. This corrected table allows anyone to compare like data for any year 1961 through 1980.

Page xii of the R.D.E.I.S.; section l.j. shows the figures 188 GPCD, ~~199~~ 119 GPCD and 124 GPCD to represent the average GPCD use and the years 1977 and 1980 respectively. However, the 188, 119 and 124 were calculated in different manors, as explained earlier, the consistancy was not followed. To be consistant the numbers should be 187, 163 and 188 to respectfully represent the average GPCD and the years 1977 and 1980. Refer to the corrected Table I-8 which is enclosed. These changes need to be made throughout the R.D.E.I.S. to provide consistancy in comparing the historical trend to the current trend. Failure to compare consistant data creates very misleading conclusions.

The R.D.E.I.S. is in error in its projections of how long a particular water supply alternative will last Cheyenne because of the errors of comparing inconsistant data (as explained above) and because the Forest Service has failed to account for seepage, evaporation and other reservoir losses. For example: the flume below the Hog Park drop measures the total amount of water brought across the continental divide and this total is used when calculating Cheyenne's total supply. However, as this water and the Crow Creek water passes through Lake Owen, Granite and Crystal Reservoirs some of the water is lost to reservoir evaporation, reservoir seepage, spilling at Crystal Lake in very wet years, broken pipelines and other losses. Table I-10 on page II-67 shows an annual average Cheyenne use of 12,506 acre feet. This is as metered by the five meters west of the city. The Table on page II-76 shows the annual average water use to be 14,053 acre feet when evaporation, seepage and other losses are accounted for. Since they do reduce the measured supply they <u>must</u> be accounted for when use projections are made. As the water supply increases there will be increased losses due to: (1) additional pipelines, (2) increased reservoir sizes, (3) more spilling at Crystal as the greater demands of the city will require additional supplies be stored in the local reservoirs and (4) the State Engineer may also impose evaporation losses on the enlarged Rob Roy and Hog Park reservoirs. The~~se~~ losses are not now accounted for by the City of Cheyenne.
Rob Roy and Hog Park evaporation

Also, the Forest Service favors an advance payback plan for releases into the North Platte River. The State Engineer will probably charge Cheyenne a 10% loss factor for transport and evaporation losses as this water is subjected to ice build up during winter transport and evaporation from Seminoe reservoir. Here again, the Forest Service <u>must</u> account for the factors that reduce the total supply available to the Cheyenne water use area.

Sincerely,

Herman Noe

Herman Noe
Director

HN:ms

Corrected as per actual data - 7/9/81
Retyped by USDA Forest Service - 10/16/81

CHEYENNE'S WATER CONSUMPTION 1980

A	B	C	D	E	F	G	H	I	
RESIDENTIAL Millions of Gallons	COMMERCIAL Millions of Gallons	INDUSTRIAL Millions of Gallons	S. CHEYENNE DISTRICT Millions of Gallons	WARREN AIR BASE Millions of Gallons	TOTAL METERED USE FOR BILLING Millions of Gallons	TOTAL SUPPLIED* Acre-Feet	TOTAL SUPPLIED* Millions of Gallons	WATER USE NOT BILLED** Millions of Gallons	MONTH
87.712	36.183	46.234	12.794	11.714	194.637	997	318.335	123.698	January
86.046	43.948	55.143	12.410	12.472	210.019	877	285.752	75.733	February
87.652	34.234	49.086	12.551	13.353	196.876	785	255.776	58.900	March
92.198	39.850	56.805	13.161	17.049	219.063	897	292.268	73.205	April
132.997	41.765	58.192	13.217	20.507	266.678	1,345	438.240	171.562	May
282.445	78.215	54.038	20.716	59.433	494.847	2,110	687.449	192.602	June
318.202	89.511	51.411	22.903	75.096	557.123	1,955	636.995	-79.872	July
310.918	86.224	72.751	26.400	53.168	549.461	1,664	542.150	-7.311	August
254.452	70.594	64.609	23.423	44.414	457.492	1,485	483.856	26.364	September
181.225	53.579	74.309	14.714	17.850	341.707	939	305.953	-35.754	October
117.235	36.294	58.318	11.439	10.140	233.426	731	238.181	4.755	November
109.151	36.955	74.388	13.018	12.013	245.525	716	233.293	-12.232	December
2060.263	647.352	715.284	196.746	347.209	3966.854	14,521	4718.248	751.394	Total

To be comparable with table I-8; Cheyenne G.P.C.D. = $\frac{4718.248 - 347.209 - 715.284}{(365) \times (53{,}226)}$ = 188 G.P.C.

Column H is produced by subtracting column F from column G (In millions of gallons)

*All water supplied to Cheyenne is metered by large meters on the supply mains between Cheyenne and the treatment plants.

**Parks, Cemetaries, Golf Courses, Greenways, Firefighting, Street Sweeping, Road Construction and averaged accounts.

Present Water Demand

Average daily water use for Cheyenne is listed in the following table.

Table I-8
Average Daily Water Uses
1961 Through 1980

Year	Population	Total Water Use MGD	Cheyenne Urban Industrial Demand MGD	Domestic Water Use MGD	Domestic Water Use GPCD
1961	43,250	10.41	3.46	6.95	161
1962	42,290	10.15	3.62	6.53	152
1963	42,730	10.85	2.61	8.24	193
1964	42,470	12.45	2.61	9.84	231
1965	42,210	9.62	2.26	7.36	175
1966	41,950	11.35	2.45	8.90	212
1967	41,690	12.14	2.25	9.89	237
1968	41,430	10.63	2.59	8.04	194
1969	41,170	10.13	2.70	7.43	180
1970	41,194	11.17	2.84	8.33	204
1971	45,794	10.77	2.73	8.04	176
1972	46,619	12.09	2.70	9.39	201
1973	47,442	12.25	2.89	9.36	197
1974	48,267	12.13	3.01	9.12	189
1975	49,092	11.80	2.93	8.87	181
1976	49,918	11.10	2.33	8.77	176
1977	50,744	9.48	1.20	8.28	163
1978	51,570	11.26	2.95	8.31	161
1979	52,395	12.08	2.83	9.25	177
1980	53,226	12.93	2.91	10.02	188
				Average	187

Corrected as per actual data 6/22/81
Retyped by USDA Forest Service 10/20/81

CD 85 AUGUST 1980

FARM REAL ESTATE MARKET DEVELOPMENTS

Computation of Real Estate Prices Using Data in Circular 85

Figures shown in the attached table are raw land, average prices by state. The base price for land in this document was taken from the WRRI Study (1979) and then updated to 1980 on a proportional basis. The formula is as follows:

$$\frac{\$750}{\$293} \quad \frac{\$X}{\$331}, \; 293X = 248{,}250, \; X = \frac{248{,}250}{293} \text{ or } \$848/\text{Ac.} \quad 1980 \text{ Price}$$

Where:

a. $750 is the 1979 low range per acre price of North Platte ranch land in Wyoming.

b. $293 average 1979 price of land in Wyoming

c. $331 average 1980 price of land in Wyoming.

d. $848 = 1980 comparable price of North Platte River valley land in Wyoming.

1979 land prices from WRRI, 1979, Cheyenne Stage II Water Project Feasibility Study.

1980 land prices from circular 85, Farm Real Estate Market Developments, 8/80.

Table 3—Farm real estate: Indexes of average value per acre of *Irrigated Land* for 11 Western States, 1950-1980, and Nebraska and Texas, 1960-80[1]

(1967=100)

Year	Mont.	Idaho	Wyo.	Colo.	New Mex.	Ariz.	Utah	Nev.	Wash.	Oreg.	Calif.	11 Western States	Nebr.[2]	Texas[2]
1950	45	55	46	47	51	51	58	41	52	44	42	46		
1951	54	63	51	56	61	58	67	49	60	47	47	53		
1952	62	68	53	60	65	64	72	55	67	51	54	59		
1953	61	71	53	57	64	67	73	58	70	54	55	60		
1954	60	70	51	57	67	66	71	58	69	53	54	59		
1955	58	73	53	59	66	71	75	56	71	54	57	62		
1956	60	77	55	60	70	73	77	58	73	55	62	65		
1957	63	76	55	60	70	79	79	60	77	57	67	68		
1958	64	78	60	63	70	84	81	60	78	58	72	72		
1959	67	84	64	65	73	91	84	64	79	59	79	77		
1960	70	88	68	67	77	97	87	66	81	60	84	81	66	91
1961	70	87	70	63	71	97	87	69	81	71	89	84	67	92
1962	82	90	73	73	81	98	89	72	82	70	92	87	71	94
1963	86	92	74	76	86	98	90	75	84	76	95	90	73	97
1964	85	92	74	82	98	98	92	79	86	80	97	92	79	99
1965	91	93	85	78	98	99	94	85	89	90	99	95	84	101
1966	97	93	83	90	101	100	97	92	95	93	100	97	93	100
1967	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1968	110	104	98	95	101	101	105	106	106	101	104	103	110	101
1969	108	108	96	103	106	101	110	111	110	106	100	103	117	98
1970	119	108	111	100	110	102	117	114	112	119	100	105	122	96
1971	129	112	125	110	110	102	124	116	113	123	99	107	123	96
1972	134	121	130	122	113	103	131	118	115	129	100	110	132	96
1973	156	140	135	141	120	104	136	122	125	129	98	114	146	101
1974	195	173	170	175	140	129	158	145	136	153	112	134	192	124
1975	241	225	186	197	164	142	175	148	145	172	127	154	238	127
1976	284	245	195	225	174	147	209	154	168	198	132	167	293	148
1977	298	272	223	260	199	175	228	154	200	204	137	181	345	158
1978	338	293	255	288	201	175	238	175	208	222	158	200	324	169
1979	389	314	293	325	[3] 209	[3] 182	[3] 248	[3] 182	226	244	190	226	395	188
1980	463	352	331	374	[3] 234	[3] 204	[3] 278	[3] 204	237	271	241	264	450	218

[1] March 1 values for 1950-1975 and February 1 values for 1976-80. Includes improvements. [2] Data not available for Nebraska and Texas prior to 1960. [3] The average rate of change for these 4 southwestern mountain States was used to calculate the individual State indexes.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

WO

RECEIVED
AUG 14 1978

REPLY TO: 2540 Water Uses and Development
RF-CC

AUG 2 1978

SUBJECT: National Forest System Water Rights

TO: Regional Foresters

REPLY DUE AUGUST 16

As a result of the recent Supreme Court ruling in the case of the United States vs. New Mexico relating to the Mimbres River adjudication, certain reserved National Forest System water rights for uses other than those to fulfill the purposes of watershed protection and timber production will be significantly affected. Until the full ramifications of the Court decision are thoroughly examined, the following interim policy has been established regarding water rights claimed for the administration of reserved lands within the National Forests:

1. The Forest Service will continue to obtain and use water in accordance with the reservation principle when the water is used for timber management or watershed management related purposes.

In view of the Court ruling, we believe that there should be no question that the following types of water uses directly related to securing favorable conditions of water flows and to furnishing a continuous supply of timber are sustainable under the Reservation Doctrine as reserved water rights:

a. Domestic water used at Ranger Stations, fire stations, work centers, and other facilities constructed and maintained for administering the NFS that include programs of watershed protection and timber production.

b. Water used in connection with fire protection and control.

c. Water used in connection with the construction and maintenance of roads used as access for timber harvesting, timber stand improvement, fire prevention and control, watershed rehabilitation, and reforestation.

d. Water used for irrigation of tree nurseries, seed orchards, and other facilities devoted primarily to the support of a continuous supply of timber or to watershed protection.

e. Water needed to maintain Forest Service riding and pack stock used in the administration of the National Forest System.

f. Water needed in connection with special uses where the permittee is engaged in activities carried out for watershed protection or timber production on National Forest System lands. This includes water for logging camps, insect and disease control work centers, work centers set up to carry out flood prevention and control programs, etc.

2. The Forest Service will continue to quantify needs for water for the development, use, and management of resources other than timber and water.

Where State water laws or water rights adjudication procedures do not recognize instream water use the Forest Service will utilize, to the fullest extent possible, other existing mechanisms and authorities for the protection of instream needs. Examples of existing mechanisms and authorities include:

a. environmental assessments made by the Forest Service.

b. comments on environmental assessments made by other agencies.

c. reports on proposed Wild and Scenic Rivers.

d. reports to the Federal Power Commission on relicense applications.

e. special-use permits, and

f. cooperative agreements and memorandums of understanding.

3. For water uses on National Forest lands by the Forest Service, or by a permittee. that are not for the purpose of watershed management or timber management:

a. Do not initiate filings for these existing Forest Service water uses.

b. Delay Forest Service development in progress or about to begin, where practical.

c. Proceed with only those developments and uses for which a firm commitment has been made, filing for a water right under State procedures except for those uses sustainable under the Reservation Doctrine. Use existing disclaimers or contact the Office of the General Counsel for standard disclaimer language.

4. In cases currently under adjudication, the Forest Service will consult with the General Counsel and/or Department of Justice attorneys on a case-by-case basis and participate in the proceedings, as appropriate.

The Office of the General Counsel is considering a meeting of their Regional Attorneys concerned with water rights. The purpose of such a meeting will be to coordinate activities within OGC and review procedures for interaction between the field offices of the Forest Service and the Office of the General Counsel in matters relating to water rights. We are currently working closely with the Office of the General Counsel and the Department of Justice in reassessing our legal and technical options and hope to clearly define our long-range policy within the next 3-4 weeks.

In the meantime, we urge you to arrange a top-level meeting with the Governors and other key State officials, as you deem appropriate, to explain our situation and work out mutually agreeable arrangements through which your immediate water needs can be met. We should, to the extent possible, insist on the water right being in the name of the United States.

We will also contact the various livestock industry organizations to solicit their cooperation in developing policies which ensure that water rights remain with the land.

You will undoubtedly receive inquiries from permittees who have in the past relied on Federal reserved rights to secure water needed for permitted activities. You can also expect that many permittees will now apply to the State for a right to that water in their name. Until a long-range policy is developed you should explain current Forest Service interpretation of the Court ruling and that we are seeking further clarification on several points. You should also point out that the United States can obtain at least the same date of appropriation as the permittee and that, by working with us, there is a good chance that we can obtain an earlier date.

If filings are initiated by permittees to obtain water rights in their name, inform the permittee and appropriate State officials of the U.S. reserved right, if applicable. If the filings affect Forest Service water uses that are not reserved, make every effort within the laws of the State to obtain water rights in the name of the United States. Protest any filings of others that are for water rights that, previously, would have been claimed by the U.S.

Where the above procedure is not acceptable to the State, and if State law allows, have permittee act as an agent of the United States and obtain the water right in the name of the United States.

In those situations where water rights cannot be claimed by the U.S., condition any new permits upon acquisition of a water right at locations specified by the Forest Service. We are studying the need to amend existing permits in such situations.

Your preliminary assessments of the potential impacts of the Court ruling, submitted in response to our letter of July 21, have been very helpful in developing this interim policy. We will need a more detailed assessment for use in developing long-range policy. I am asking each of you to report the following information by August 16. Some of these questions may be appropriate subjects for discussion at a top-level meeting with the Governor or other State official. You may need to contact a State water rights administration agency to obtain some of this information.

1. Do any States have special procedures or exemptions for any type of water use? For example, certain States do not issue water permits for livestock or domestic use if the diversion is less than a specified quantity.

2. Will States accept the date the water was put to beneficial use by the Forest Service, or other party, as the date of appropriation? If not, what date is acceptable to the State?

3. What problems will arise from a priority date of 1960 or 1978 for consumptive and nonconsumptive water uses? If possible, provide quantitative information such as number of Forest Service diversions affected and the amount of water.

4. What is your best estimate of the number of miles of streams in which existing streamflow may not be adequate to meet instream flow needs for National Forest administration?

5. How beneficial is a priority date of 1960 or 1978 for instream flow?

6. Under State law, are water rights specific to a point of use, and type of use, or can a holder of a water right change the point of use, or type of use, at his discretion?

This assessment should also be of value to you in determining those actions most appropriate in dealing with each State.

Where more than one Region is involved with a State you should coordinate your contacts with State officials.

Please keep us advised of any problems encountered in applying this interim policy.

John R. McGuire

JOHN R. McGUIRE, Chief

Limited Distribution

MAINTENANCE FLOW RECOMMENDATIONS FOR ALTERNATIVES B,C,D

The following recommendations reported in Jespersen (1979, 1980) nad Wesche et al. (1977), should be formally stipulated in the permit authorizing Stage II of the Cheyenne water development project.

1\.

Stream	Maintenance Flow (cfs)	Flushing Flows (cfs)
Rose Creek	0.75	9.0
Green Timber Creek	1.0	14.0
North Fork	2.0	30.0
Ted Creek	1.0	19.0
Third Creek	1.0	11.0
Deadman Creek	2.0	35.0
Harrison Creek	1.0	9.0
Solomon Creek	1.0	12.5
Rabbit Creek	1.5	18.0
West Branch	3.5	92.0
Roaring Fork	1.0	31.5
Sherard Creek	0.5	12.0
Douglas Creek	5.5	130.0
Nugget Gulch Creek	0.2	4.5
Little Beaver Creek	0.35	7.0
Camp Creek	0.2	2.0
Lake Creek	0.5	8.5
Horse Creek	0.2	0.0

The above recommended maintenance flows should read "x cubic feet per second, or the natural flow, whichever is less," with the exception of Douglas Creek which is 5.5 cubic feet per second constant flow. All flushing flows are recommended for a 72 hour (three day) period coinciding with natural peak spring runoff. Not all action alternatives divert the entire lisitng of streams, therefore these maintenance and flushing flows would be required as they apply each alternative.

It is also recommended that:

> A blanket minimum flow be maintained on all streams for which a fishery maintenance flow was not recommended. This blanket minimum flow will require that all flow be bypassed starting the first of July until approximately the first week in November or as long as adequate access is still availablle.

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Douglas Creek	5.5	130.0
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Camp Creek	0.2	2.0
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Horse Creek	0.2	0.0

The above recommended maintenance flows should read "x cubic feet per second, or the natural flow, whichever is less," with the exception of Douglas Creek which is 5.5 cubic feet per second constant flow. All flushing flows are recommended for a 72 hour (three day) period coinciding with natural peak spring runoff.

It is also recommended that:

> A blanket minimum flow be maintained on all streams for which a fishery maintenance flow was not recommended. This blanket minimum flow will require that all flow be bypassed starting the first of July until approximately the first week in November or as long as adequate access is still available.

APPENDIX III

CONTENTS PAGE

Summary of Methodology

Determination of the three levels of population growth for the study municipalities made use of county and state population projections for the years 1980, 1985, 1990, and 2000 from two primary sources (Wyoming Department of Administration and Fiscal Control (DAFC) and the U. S. Bureau of Census) and numerous secondary sources (see sources).

Both DAFC and the Census Bureau provided projections based upon models using procedures which analyze both natural increase and migration. The DAFC state and county projections were based upon a revision of the Wyoming Population and Employment Forecast Report, June 1979, which relies heavily upon empirical information gathered in Wyoming. The projections of Wyoming's state population by the Census Bureau rely upon a cohort-component method which is dependent upon more historical information. The Census Bureau reports three series of projections, the lowest of which was chosen for this study to develop the low growth rate trend.

Neither primary source provide projections at the municipal level. The Institute for Policy Research (IPR) investigated trend extrapolation, comparative forecasting, density ceiling and ratio trend methods of disaggregating the higher geographic level projections to the municipal levels. The ratio trend method was selected as the most appropriate. This step down technique takes advantage of the tendency for population projections at the large scale to represent degrees of reliability that are more difficult to achieve at a small scale of analysis. The large scale projections, county or state, act as a constraint on potential

population levels for the aggregation of municipality projections. Since this method relies upon historical trends, it must be recognized that historical trends may not hold in the future. However, mitigation of this tendency was attempted in two ways. (1) Wyoming's current period of rapid change, 1970-77, was selected for relationship analysis under the assumption that inmigration trends following 1970 differ significantly from earlier periods. Census Bureau population estimates are also available at more frequent intervals at the municipal level during this period. (2) The ratio trend assumption of constant relationships was modified through regression analysis to forecast changes in the ratio of municipal population to county population. The municipality's share of the county population was regressed upon the county's share of the study region's population during 1970-77. This relationship captures the influence of regional growth upon the municipalities in addition to county changes. Locational effects of mine or plant placement as outlined in the Mineral Development Monitoring System, Wyoming Department of Economic Planning and Development were reviewed but not entered <u>explicitly</u> in the municipality allocation process. Travel distances, workers are willing to commute to secure the amenities of relatively more urban living, influence the distribution of population. However, these remain constant due to fixed road networks and thus do not enter the time series regression analysis employed. Distributional effects were investigated for the influence of a hierarchy of towns and cities upon the municipality under study. The forecast distributions were not drastically changed when these effects were explicitly included. Both

mineral development and locational attraction effects are implicit on a county level through the county growth projections provided by DAFC. They are also captured by allocating the Census state projections to the county level through a procedure using the ratio of the change in county population in the DAFC projections to the change in the state projections.

The forecasted ratio of municipal population to county population was applied to both the DAFC forecasted county populations and the county allocations of Census Bureau state populations. The resulting municipal population forecasts were therefore based upon two differing growth rate assumptions.

The three growth rates requested to base the cost benefit analysis upon were developed through an additional literature search of local population projections for land use planning, water planning and other municipal planning functions. The population estimates and forecasts gathered by Wright Water Engineers, Inc. as part of this study (see appendix C) were also incorporated. The range of population forecasts for any single municipality varies widely, in most instances, following the pattern of the local being the highest to the disaggregation of the Census Bureau state projections being the lowest. Projections collected from all sources were integrated into a rank ordering along with the forecasts by DAFC-IPR in order to construct envelopes of the high and low projections. These upper and lower forecast boundaries were selected

from the highest and the lowest projection for each future period regardless of source or methodology. These extremes provide composite high and low growth rates and generate a band within which future population is most likely to be found. For planning purposes, the mean of this range may be considered to be an appropriate forecast. A composite averaging method of all the available projections was used to develop the third growth rate projections. This method incorporates the influence of the wide variety of assumptions and methodologies upon which the various projections were based.

The boundaries of the high and low projections combined with the "composite average" projection provide three different levels of growth which may be faced by the counties and municipalities under study. These growth rates for Cheyenne are illustrated in Figure B-1.

TABLE A-1

Douglas Creek above Keystone, Wyoming (06-6204)
NAME OF STATION

STATION LOCATION Sec. 16, T14N, R79W
DRAINAGE AREA 22.1 square miles
QUANTITIES IN Acre Feet

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT	TOTAL	
1947	369	241	203	165	148	184	219	12394	13001	2530	510	303	30267	
1948	361	248	209	180	160	148	732	11408	6361	1141	361	225	21534	
1949	345	239	209	182	165	119	1007	11021	15081	1873	432	302	30975	
1950	362	232	210	179	160	143	410	8640	14158	1690	379	348	26911	
1951	290	163	208	171	156	137	310	13548	13414	1647	447	207	30698	
1952	513	191	203	186	170	128	887	14688	11275	956	374	219	29790	
1953	209	189	196	168	158	132	287	4397	10109	1232	462	155	17694	
1954	219	163	185	168	143	137	752	5299	2577	369	239	212	10463	
1955	223	201	189	140	132	184	378	3751	4208	594	370	167	10537	
*1956	226	208	215	246	201	246	584	13760	6010	698	341	184	22920	
*1957	235	190	172	135	111	111	131	2570	21960	4100	661	293	30670	
*1958	409	208	185	154	100	80	1190	17048	9824	651	293	250	30392	
*1959	176	152	129	111	94	98	188	6212	14311	1104	378	296	23250	
*1960	721	357	215	185	144	154	1329	9648	6270	714	261	197	20194	
*1961	196	215	185	154	111	142	479	8352	6865	706	393	786	18584	
*1962	1050	728	436	332	303	360	2329	12359	8854	1372	362	234	28719	
*1963	274	167	125	102	109	156	254	10688	4449	614	373	276	17584	
*1964	211	208	194	210	195	207	344	7068	11510	1563	438	272	22420	
*1965	227	235	280	279	246	253	256	7027	13379	1438	394	244	24257	
1966	1306	373	263	221	178	110	1024	6317	3959	571	273	179	14774	
1967	229	175	186	164	154	126	509	5675	12275	1697	268	319	21777	
1968	485	240	216	208	175	143	406	6138	20705	2424	475	314	31929	
1969	324	225	208	214	167	128	1083	11270	8006	1495	401	235	23756	
1970	289	281	212	202	167	183	470	12384	19852	2879	498	226	37643	
1971	986	249	225	181	152	126	1298	13682	21798	2855	503	249	42304	
1972	277	212	197	165	160	116	645	4926	9378	703	341	194	17314	
1973	221	182	191	168	147	146	270	9987	13656	1767	405	228	27368	
1974	240	240	192	151	152	146	517	18987	9983	1059	342	173	32182	
1975	272	148	141	114	123	173	265	7144	9945	1302	314	174	20115	
n	29	29	29	29	29	29	29	29	29	29	29	29	29	
$\bar{x}$	388	237	206	181	158	156	640	9531	11144	1439	389	258	24725	
s	280	108	54	48	42	55	479	4113	5301	856	90	114	7510	
%	1.57	0.96	0.83	0.73	0.64	0.63	2.59	38.54	45.07	5.82	1.57	1.04	100%	

*Measured Streamflow

TABLE A-2 (HISTORIC)

Douglas Creek Near Foxpark, Wyoming (06-6210)
NAME OF STATION

STATION LOCATION Sec. 19, T13N, R79W
DRAINAGE AREA 120 square miles
QUANTITIES IN Acre Feet

YEAR	OCT	NOV.	DEC.	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT	TOTAL	
1946	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	763	559	-1	
1947	1194	799	615	307	278	430	1488	33824	23460	4814	1619	970	69800	
1948	1168	833	676	584	518	584	3689	31228	9882	2182	714	551	52609	
1949	1111	786	676	615	611	1045	5058	30208	28070	3568	1041	966	73755	
1950	1172	752	615	553	522	615	2082	23942	26007	3221	783	1213	61478	
1951	899	819	799	738	611	676	1579	36361	24363	3140	1132	585	72201	
1952	1597	893	799	676	575	799	4462	39862	19745	1831	765	412	72416	
1953	498	498	492	615	555	738	1468	12772	17304	2354	1230	432	38955	
1954	557	762	676	615	500	676	3785	15146	3312	718	360	369	27476	
1955	579	476	492	430	361	430	1918	11072	5994	1144	749	296	23941	
1956	451	446	461	492	432	738	3943	27919	8078	1115	670	323	45069	
1957	435	535	523	492	417	553	1012	22247	45068	7626	1410	742	81059	
1958	1291	899	922	861	722	738	2805	37942	15158	1436	585	518	63876	
1959	511	657	584	553	527	738	2569	26741	21830	2210	810	677	58408	
1960	1898	1519	861	738	633	1577	7783	20551	9671	1383	387	371	47371	
1961	582	546	476	445	389	579	1920	21471	12430	1396	914	1958	43107	
1962	2531	1932	1027	676	621	751	10235	37970	15905	2648	774	582	75651	
1963	914	551	387	236	288	680	3628	21231	7218	1075	776	502	37485	
1964	309	444	278	180	166	192	563	17155	18301	2015	424	441	40469	
1965	358	324	247	238	221	232	777	26844	27047	2743	1010	1497	61539	
1966	2658	1573	1383	1049	577	1105	4770	14203	4983	996	442	327	34066	
1967	579	443	504	467	263	788	2515	15535	17373	1562	260	577	40867	
1968	1418	670	526	476	415	508	2059	17355	36936	4018	1073	1176	66630	
1969	881	505	474	545	521	649	5647	28185	11290	5750	547	362	55356	
1970	712	611	466	323	265	247	2198	32519	35664	4465	1295	1339	80104	
1971	1920	1285	853	795	647	690	6630	36317	43680	4544	1277	2812	101452	
1972	734	-1	-1	-1	-1	-1	-1	11958	13150	743	337	485	-1	
n	26	25	25	25	25	25	25	26	26	26	27	27	25	
$\bar{x}$	1037	782	633	548	463	670	3383	25040	19305	2642	820	779	56102	
s	643	398	249	205	151	287	2330	9039	11569	1719	355	580	19054	
%	1.85	1.39	1.13	0.98	0.83	1.19	6.03	44.63	34.41	4.71	1.46	1.37	100%	

(-1) denotes missing data

TABLE A-3 (RECONSTRUCTED)

Douglas Creek, near Foxpark, Wyoming (06-6210)
NAME OF STATION

STATION LOCATION Sec. 19, T13N, R79W
DRAINAGE AREA 120 square miles
QUANTITIES IN Acre Feet

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT	TOTAL
SAME AS TABLE A-2 (HISTORIC)													
1963												805	37788
1964	557	699	530	421	374	382	800	17589	18812	2449	760	578	43921
1965	531	521	464	359	389	404	994	27683	28089	3412	1321	1677	65844
1966	2741	1670	1443	1111	640	1504	5145	17827	5568	1101	442	391	39583
1967	612	518	566	529	317	850	2575	16137	21883	3234	429	657	48307
1968	1530	143	774	705	586	618	2059	17355	41185	4612	1318	1005	71890
1969	1036	655	629	701	661	804	5439	30864	13050	2853	880	527	58099
1970	898	791	652	482	433	433	2378	33797	39140	5475	1512	1600	87591
1971	2397	1527	1025	950	787	845	6510	37214	43827	5428	1555	1320	103385
1972	845	-1	-1	-1	-1	-1	-1	14165	15801	1352	643	773	-1
n	26	25	25	25	25	25	25	26	26	26	27	27	-
$\bar{x}$	1098	809	687	595	510	727	3413	25524	20033	2761	902	772	57831
s	663	422	235	197	137	293	2299	8877	11976	1695	366	440	-
%	1.90	1.40	1.19	1.03	0.88	1.26	5.90	44.14	34.64	4.77	1.56	1.33	100%

(-1) denotes missing data

1

NORTH FORK LITTLE SNAKE RIVER-NEAR ENCAMPMENT,WYOMING
GAGE 09-2518 MINUS PROJECTED STAGE 1 DIVERSIONS
ALL VALUES IN THOUSAND ACRE FEET (UNLESS OTHERWISE NOTED)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL	PCT OF AV ANN
1940	0.22	0.17	0.15	0.13	0.13	0.18	0.66	4.06	3.01	0.94	0.35	0.27	10.27	73.5
1941	0.27	0.20	0.16	0.14	0.13	0.20	0.51	4.81	3.86	1.13	0.52	0.39	12.32	88.2
1942	0.63	0.48	0.32	0.20	0.14	0.18	1.32	3.80	6.31	1.27	0.36	0.27	15.48	110.8
1943	0.19	0.25	0.23	0.14	0.13	0.18	1.02	2.47	5.68	1.25	0.39	0.22	12.15	87.0
1944	0.23	0.20	0.14	0.12	0.10	0.16	0.41	2.76	6.63	1.36	0.24	0.19	12.54	89.8
1945	0.14	0.15	0.12	0.11	0.09	0.14	0.38	3.92	7.77	3.28	0.88	0.34	17.32	124.0
1946	0.31	0.42	0.36	0.23	0.20	0.25	1.17	3.04	4.16	0.98	0.35	0.26	11.73	84.0
1947	0.43	0.25	0.22	0.17	0.14	0.27	0.57	4.99	4.75	1.80	0.46	0.28	14.33	102.6
1948	0.39	0.29	0.28	0.20	0.14	0.18	0.75	4.16	3.41	1.03	0.36	0.26	11.45	82.0
1949	0.18	0.27	0.21	0.17	0.13	0.18	0.86	5.02	8.17	1.85	0.38	0.29	17.71	126.8
1950	0.52	0.32	0.23	0.17	0.13	0.17	0.91	3.87	7.00	1.63	0.37	0.30	15.62	111.8
1951	0.25	0.26	0.23	0.16	0.10	0.17	0.57	3.93	4.78	1.58	0.44	0.25	12.72	91.1
1952	0.44	0.17	0.18	0.16	0.13	0.16	0.87	6.08	7.34	1.19	0.40	0.24	17.36	124.3
1953	0.12	0.12	0.14	0.13	0.11	0.18	0.45	1.48	6.00	1.10	0.37	0.22	10.42	74.6
1954	0.12	0.19	0.16	0.15	0.14	0.16	0.63	2.50	2.81	0.60	0.22	0.27	7.95	56.9
1955	0.22	0.14	0.16	0.13	0.10	0.15	0.55	3.31	3.89	0.94	0.34	0.22	10.15	72.7
1956	0.16	0.22	0.26	0.17	0.12	0.18	0.92	5.47	4.34	0.90	0.30	0.20	13.24	94.8
1957	0.15	0.13	0.13	0.12	0.12	0.16	0.32	-0.78	11.18	4.55	0.56	0.22	16.86	120.7
1958	0.31	0.29	0.27	0.21	0.21	0.27	0.60	9.02	3.76	0.89	0.22	0.19	16.24	116.3
1959	0.11	0.12	0.11	0.10	0.09	0.11	0.39	2.49	4.61	0.94	0.32	0.27	9.66	69.2
1960	0.73	0.55	0.30	0.24	0.19	0.25	0.96	3.45	4.22	0.89	0.23	0.12	12.13	86.8
1961	0.13	0.12	0.12	0.11	0.09	0.18	0.55	4.24	3.46	0.78	0.35	0.54	10.67	76.4
1962	0.75	0.58	0.42	0.26	0.35	0.27	1.32	4.07	4.49	1.54	0.31	0.17	14.53	104.0
1963	0.19	0.17	0.19	0.13	0.12	0.14	0.29	4.78	2.89	0.68	0.36	0.26	10.20	73.0
1964	0.18	0.20	0.15	0.14	0.12	0.17	0.54	2.27	7.22	1.89	0.43	0.60	13.91	99.6
1965	0.19	0.18	0.18	0.18	0.15	0.17	0.48	1.76	9.15	3.13	0.60	0.53	16.70	119.6
1966	0.60	0.33	0.25	0.18	0.12	0.22	0.68	3.32	3.04	0.69	0.27	0.22	9.92	71.0
1967	0.24	0.17	0.22	0.16	0.12	0.18	0.51	1.90	6.78	2.42	0.41	0.37	13.48	96.5
1968	0.38	0.25	0.22	0.17	0.14	0.17	0.38	2.73	9.62	1.86	0.50	0.34	16.76	120.0
1969	0.39	0.24	0.27	0.20	0.16	0.18	0.84	4.55	3.30	1.72	0.33	0.29	12.47	89.3
1970	0.37	0.30	0.27	0.19	0.17	0.20	0.38	4.76	8.54	2.25	0.45	0.39	18.27	130.8
1971	0.51	0.37	0.31	0.24	0.17	0.19	0.89	4.37	9.88	3.11	0.43	0.35	20.82	149.1
1972	0.38	0.26	0.22	0.13	0.16	0.29	0.67	3.16	5.76	1.06	0.31	0.29	12.69	90.9
1973	0.34	0.34	0.32	0.23	0.24	0.20	0.36	3.49	6.92	2.39	0.63	0.36	15.82	113.3
1974	0.25	0.27	0.25	0.18	0.16	0.21	1.44	8.15	7.21	1.65	0.37	0.25	20.39	146.0
1975	0.22	0.16	0.18	0.20	0.13	0.17	0.37	1.95	8.89	5.18	0.57	0.29	18.31	131.1
1976	0.32	0.34	0.26	0.18	0.15	0.17	0.54	4.11	5.61	2.18	0.50	0.29	14.65	104.9
1977	0.28	0.22	0.12	0.12	0.13	0.15	0.54	1.88	3.35	0.56	0.26	0.25	7.86	56.3
1978	0.23	0.30	0.24	0.17	0.16	0.20	0.69	3.34	10.10	3.39	0.49	0.30	19.61	140.4
AVERAGE	0.31	0.26	0.22	0.17	0.14	0.19	0.67	3.71	5.89	1.71	0.40	0.29	13.97	
STD DEV	0.18	0.11	0.07	0.04	0.05	0.04	0.29	1.73	2.34	1.07	0.13	0.10	3.39	
CV (%)	58.87	43.38	33.11	24.12	32.79	21.11	43.50	46.69	39.65	62.46	32.44	33.59	24.24	
% ANNUAL	2.25	1.83	1.57	1.20	1.03	1.35	4.83	26.56	42.20	12.22	2.87	2.09	100.00	

NORTH FORK LITTLE SNAKE RIVER NEAR SLATER, COLORADO
GAGE 09-2519 FLOWS PROJECTED STAGE I DIVERSIONS
ALL VALUES IN THOUSAND ACRE FEET (UNLESS OTHERWISE NOTED)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL	PCT OF AV ANN
1940	0.38	0.31	0.23	0.22	0.23	0.34	1.82	10.17	5.48	1.21	0.53	0.33	21.25	76.6
1941	0.45	0.35	0.26	0.25	0.24	0.42	1.21	11.72	7.17	1.46	0.78	0.49	24.80	89.4
1942	0.22	0.79	0.63	0.42	0.26	0.35	4.22	10.11	11.06	1.69	0.55	0.33	30.63	110.4
1943	0.33	0.43	0.42	0.24	0.23	0.37	3.56	7.58	9.92	1.66	0.60	0.27	25.61	92.3
1944	0.39	0.35	0.21	0.17	0.13	0.29	0.75	8.32	11.57	1.82	0.37	0.23	24.60	88.7
1945	0.27	0.28	0.15	0.15	0.08	0.25	0.65	10.87	13.72	4.47	1.34	0.43	32.66	117.7
1946	0.50	0.70	0.74	0.50	0.46	0.55	4.37	8.26	7.30	1.26	0.53	0.32	25.49	91.9
1947	0.57	0.43	0.39	0.33	0.27	0.64	1.47	12.32	8.77	2.42	0.70	0.35	28.76	103.6
1948	0.67	0.50	0.54	0.42	0.27	0.35	2.14	10.47	6.38	1.32	0.54	0.33	23.88	86.1
1949	0.33	0.45	0.37	0.32	0.24	0.35	2.54	12.44	14.10	2.50	0.57	0.35	34.56	124.5
1950	0.79	0.53	0.42	0.35	0.23	0.33	2.72	10.30	12.20	2.20	0.56	0.37	31.00	111.7
1951	0.42	0.44	0.42	0.31	0.12	0.32	1.46	10.27	8.65	2.10	0.67	0.31	25.49	91.9
1952	0.53	0.30	0.29	0.29	0.22	0.29	2.83	14.56	13.02	1.64	0.60	0.29	35.01	126.2
1953	0.24	0.22	0.21	0.22	0.14	0.35	0.91	5.68	10.25	1.43	0.56	0.27	20.48	73.8
1954	0.25	0.33	0.26	0.27	0.27	0.30	1.78	6.72	4.34	0.75	0.33	0.33	15.93	57.4
1955	0.38	0.25	0.26	0.23	0.13	0.26	1.34	8.72	6.85	1.20	0.51	0.26	20.39	73.5
1956	0.30	0.37	0.50	0.32	0.18	0.37	2.72	13.60	7.30	1.02	0.44	0.24	27.36	98.6
1957	0.22	0.18	0.16	0.20	0.21	0.27	0.91	3.85	19.47	6.45	0.93	0.46	33.31	120.0
1958	0.54	0.55	0.48	0.42	0.35	0.42	1.39	15.16	8.34	1.15	0.47	0.32	29.59	106.6
1959	0.28	0.29	0.25	0.22	0.19	0.25	0.78	7.29	8.69	1.25	0.45	0.36	20.30	73.2
1960	1.15	0.89	0.45	0.39	0.31	0.45	3.93	9.99	7.42	1.38	0.36	0.21	26.93	97.0
1961	0.30	0.24	0.24	0.22	0.20	0.36	1.22	7.67	5.55	0.99	0.51	0.70	18.20	65.6
1962	1.11	0.99	0.88	0.66	1.08	0.91	4.89	13.05	9.78	2.32	0.46	0.31	36.44	131.3
1963	0.41	0.34	0.24	0.17	0.18	0.25	0.58	9.10	4.77	0.91	0.53	0.30	17.78	64.1
1964	0.25	0.29	0.20	0.22	0.13	0.25	0.56	9.33	10.71	2.38	0.54	0.32	25.18	90.7
1965	0.28	0.29	0.42	0.36	0.28	0.31	1.23	9.20	15.17	3.66	0.86	0.64	32.70	117.8
1966	0.91	0.56	0.48	0.36	0.20	0.47	2.04	8.43	5.06	0.87	0.40	0.26	20.04	72.2
1967	0.41	0.30	0.41	0.30	0.22	0.35	1.16	6.89	11.87	3.27	0.62	0.46	26.26	94.6
1968	0.50	0.43	0.39	0.35	0.26	0.33	0.67	8.73	16.53	2.53	0.76	0.42	32.00	115.3
1969	0.62	0.42	0.51	0.43	0.34	0.34	2.67	11.23	6.27	2.30	0.50	0.37	26.00	93.7
1970	0.58	0.51	0.51	0.39	0.36	0.40	0.66	12.35	14.92	3.05	0.68	0.49	34.90	125.8
1971	0.78	0.62	0.61	0.55	0.35	0.39	2.90	11.82	17.10	4.22	0.66	0.44	40.44	145.7
1972	0.59	0.45	0.39	0.21	0.35	0.67	2.02	8.84	10.08	1.37	0.46	0.36	25.79	92.9
1973	0.55	0.58	0.63	0.51	0.59	0.40	0.58	9.78	12.17	3.25	0.96	0.45	30.45	109.7
1974	0.42	0.46	0.46	0.35	0.34	0.46	5.74	18.33	12.93	2.25	0.57	0.30	42.61	153.6
1975	0.38	0.29	0.30	0.44	0.24	0.31	0.64	7.54	15.50	7.00	0.87	0.36	33.87	122.1
1976	0.51	0.58	0.50	0.35	0.30	0.31	1.30	10.83	10.13	2.91	0.75	0.36	28.83	103.9
1977	0.45	0.38	0.14	0.19	0.24	0.25	1.27	5.62	5.16	0.70	0.39	0.30	15.09	54.4
1978	0.39	0.50	0.45	0.34	0.32	0.40	2.09	9.99	17.40	4.61	0.74	0.38	37.61	135.5
AVERAGE	0.49	0.44	0.39	0.32	0.28	0.38	1.94	9.93	10.34	2.28	0.61	0.36	27.75	
STD DEV	0.23	0.18	0.17	0.11	0.16	0.13	1.32	2.81	3.98	1.47	0.20	0.10	6.67	
CV (%)	46.91	40.79	42.42	35.41	59.48	34.75	67.88	28.35	38.49	64.24	32.52	28.11	24.04	
* ANNUAL	1.75	1.59	1.42	1.17	0.99	1.36	7.00	35.77	37.25	8.22	2.19	1.30	100.00	

LITTLE SNAKE RIVER NEAR SLATER, COLORADO
GAGE 09-2530 MINUS PROJECTED STAGE 1 DIVERSIONS
ALL VALUES IN THOUSAND ACRE FEET (UNLESS OTHERWISE NOTED)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL	PCT OF AV ANN
1940	1.65	1.51	1.34	1.38	1.67	2.47	15.04	62.98	23.73	4.16	2.00	1.45	119.38	74.4
1941	1.93	1.67	1.45	1.54	1.68	3.22	10.08	75.47	36.16	5.20	3.24	2.65	144.29	90.0
1942	5.70	3.43	2.81	2.41	1.75	2.58	34.49	65.58	58.61	6.64	2.10	1.39	186.99	116.6
1943	1.45	1.99	2.02	1.47	1.66	2.70	30.39	46.57	50.80	6.50	2.34	0.93	148.83	92.8
1944	1.69	1.66	1.26	1.08	1.26	1.97	6.12	53.48	61.55	7.30	1.21	0.66	139.26	86.8
1945	1.21	1.38	1.02	1.00	1.13	1.52	5.28	75.26	76.61	19.36	5.98	2.18	191.93	119.7
1946	2.13	3.11	3.26	2.82	2.47	4.56	37.64	48.91	34.09	4.38	2.03	1.33	146.73	91.5
1947	2.57	1.99	1.91	1.94	1.81	5.43	12.26	81.93	46.83	10.01	2.84	1.55	171.37	106.8
1948	2.65	2.27	2.46	2.41	1.80	2.57	17.65	66.00	30.94	4.65	2.06	1.38	136.84	85.3
1949	1.45	2.10	1.84	1.91	1.70	2.55	20.97	83.31	76.77	10.42	2.21	1.60	206.83	129.0
1950	3.37	2.40	2.03	2.02	1.66	2.36	22.37	67.63	65.53	9.11	2.14	1.73	182.35	113.7
1951	1.82	2.03	2.01	1.84	1.25	2.26	12.13	66.26	44.88	8.33	2.70	1.27	146.78	91.5
1952	2.90	1.47	1.56	1.76	1.64	1.91	24.05	100.03	72.53	7.06	2.35	1.12	218.38	136.2
1953	1.07	1.17	1.26	1.40	1.32	2.56	7.38	32.06	51.28	5.25	2.15	0.95	107.85	67.2
1954	1.12	1.61	1.43	1.63	1.80	1.98	15.00	33.49	10.44	2.26	1.05	1.43	73.24	45.7
1955	1.64	1.28	1.43	1.44	1.30	1.60	10.99	51.90	31.31	4.15	1.90	0.91	109.85	68.5
1956	1.31	1.77	2.33	1.91	1.46	2.72	26.17	84.45	38.97	3.92	1.60	0.73	167.34	104.3
1957	1.09	1.91	1.53	1.60	1.66	2.32	8.82	59.39	109.45	27.80	3.90	1.81	221.28	138.0
1958	3.11	2.91	2.63	3.00	3.05	3.44	11.62	96.59	47.29	4.42	1.50	1.51	181.07	112.9
1959	1.23	1.08	1.23	1.54	1.50	2.07	6.98	39.52	32.93	4.44	1.88	1.60	96.00	59.9
1960	4.62	3.03	1.57	1.75	1.40	3.68	27.20	50.06	34.37	4.57	1.18	0.82	134.25	83.7
1961	1.11	1.53	1.66	1.26	1.42	3.33	6.51	43.47	28.35	3.67	2.12	4.34	98.77	61.6
1962	5.45	4.55	3.49	3.05	3.28	3.42	44.01	86.62	46.21	8.73	1.73	1.22	211.76	132.0
1963	1.56	1.24	1.17	1.10	2.38	4.04	7.65	47.06	21.09	2.56	1.78	1.23	92.86	57.9
1964	1.14	1.42	1.20	1.39	1.33	1.49	4.87	61.30	57.44	9.80	2.06	1.34	144.78	90.3
1965	1.23	1.42	2.03	2.07	1.84	2.10	9.87	63.10	84.17	15.68	3.64	3.78	190.93	119.0
1966	4.00	2.56	2.24	2.08	1.56	3.71	17.30	47.45	17.37	2.78	1.38	0.92	103.35	64.4
1967	1.77	1.46	1.99	1.80	1.62	2.50	9.47	44.34	63.66	13.65	2.48	2.41	147.15	91.7
1968	2.58	2.00	1.91	2.02	1.78	2.28	5.45	59.95	91.83	10.75	3.12	2.09	185.76	115.8
1969	2.65	1.95	2.36	2.44	2.05	2.43	22.56	71.78	30.82	9.27	1.89	1.68	151.88	94.7
1970	2.51	2.31	2.36	2.22	2.12	3.05	5.41	85.60	83.49	12.90	2.80	2.71	207.48	129.4
1971	3.36	2.81	2.72	3.04	2.08	2.93	24.55	83.14	96.50	17.97	2.63	2.24	243.97	152.1
1972	2.55	2.08	1.91	1.31	2.06	5.80	17.10	55.79	52.11	4.83	1.68	1.66	148.88	92.8
1973	2.36	2.63	2.82	2.87	2.90	3.05	4.74	65.07	66.07	13.80	4.10	2.31	172.74	107.7
1974	1.32	2.13	2.18	2.06	2.04	3.62	49.75	127.32	72.97	9.52	2.19	1.22	276.82	172.6
1975	1.64	1.42	1.59	2.47	1.70	2.13	5.18	53.14	86.98	29.87	3.67	1.64	191.43	119.4
1976	2.19	2.62	2.34	2.05	1.91	2.17	10.70	72.62	54.65	11.86	3.10	1.61	167.22	104.3
1977	1.95	1.78	0.97	1.21	1.70	1.51	10.39	25.77	14.88	2.05	1.35	1.20	64.76	40.4
1978	1.69	2.28	2.15	2.01	1.97	3.07	17.67	70.36	97.78	19.82	3.03	1.77	223.60	139.4
AVERAGE	2.23	2.05	1.94	1.91	1.81	2.80	16.30	64.21	53.88	9.22	2.39	1.65	160.38	
STD DEV	1.11	0.71	0.61	0.56	0.48	0.98	11.29	20.44	25.31	6.60	0.96	0.76	47.77	
CV (%)	49.85	34.77	31.43	29.52	26.27	34.95	69.24	31.83	46.96	71.57	40.24	46.12	29.78	
% ANNUAL	1.39	1.28	1.21	1.19	1.13	1.74	10.16	40.03	33.60	5.75	1.49	1.03	100.00	

LITTLE SNAKE RIVER NEAR DIXON, WYOMING
GAGE 09-2570 WINDS PROJECTED STAGE I DIVERSIONS
ALL VALUES IN THOUSAND ACRE FEET (UNLESS OTHERWISE NOTED)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL	PCT OF AV ANN
1940	2.07	3.51	3.61	3.56	4.56	8.78	44.22	138.24	36.62	0.73	0.25	0.60	246.75	72.3
1941	2.82	3.97	3.90	3.99	4.67	13.58	30.83	173.31	64.22	2.75	2.84	3.17	310.05	90.9
1942	11.85	6.97	7.44	6.38	5.43	9.46	96.70	146.32	112.67	5.68	0.46	0.47	411.83	120.7
1943	1.54	4.14	4.85	4.53	5.50	14.64	77.22	92.94	113.39	6.25	0.75	0.44	326.19	95.6
1944	2.09	4.40	3.63	3.48	4.16	6.44	22.08	138.30	132.54	8.72	0.37	0.26	326.47	95.7
1945	2.00	4.22	4.33	4.20	4.86	9.61	34.81	192.06	167.95	38.47	9.53	3.82	476.52	139.6
1946	5.51	7.50	6.45	6.08	6.53	14.48	85.52	88.49	58.92	2.17	0.68	0.70	283.03	82.9
1947	4.03	5.45	4.57	3.91	4.78	27.70	51.92	164.21	93.27	12.55	2.12	2.10	376.61	110.4
1948	4.70	5.67	6.52	6.39	5.95	9.39	51.26	146.87	52.74	1.68	0.38	0.44	292.05	85.6
1949	1.53	5.19	4.90	5.00	4.86	9.26	60.24	195.82	152.38	13.11	0.69	0.91	453.89	133.0
1950	6.67	6.05	5.41	5.31	4.43	7.84	64.00	152.20	127.94	10.56	0.54	1.20	392.15	114.9
1951	4.02	5.31	5.95	5.84	5.64	9.47	37.98	125.80	78.56	5.38	0.51	0.41	284.87	83.5
1952	3.34	4.52	5.30	5.20	5.54	6.10	91.85	269.53	166.30	8.31	0.47	0.39	569.35	166.8
1953	2.64	3.74	5.15	5.86	5.18	9.11	22.82	89.08	106.19	2.36	1.39	0.18	253.70	74.3
1954	1.09	5.52	4.57	5.27	5.05	6.79	48.94	64.27	11.87	0.37	0.39	0.59	154.72	45.3
1955	1.45	3.41	4.47	3.91	3.35	5.80	36.03	101.74	49.31	1.17	0.02	0.12	210.79	61.8
1956	0.94	2.15	5.75	4.34	4.07	9.57	61.36	149.50	58.96	0.76	0.30	0.12	297.32	87.1
1957	0.68	3.28	4.16	4.78	5.13	8.61	29.07	137.16	199.75	49.69	4.76	2.48	449.57	131.7
1958	0.44	7.97	7.53	6.41	6.24	11.12	41.78	221.82	80.10	0.69	0.15	0.31	390.56	114.4
1959	1.75	3.44	4.61	4.92	4.72	6.88	22.04	66.23	48.99	3.26	0.35	1.52	168.71	49.4
1960	3.19	6.75	3.07	3.78	3.61	17.11	82.60	98.91	62.91	0.89	0.14	0.07	288.33	84.5
1961	0.37	2.72	3.36	2.87	3.20	9.63	17.66	67.67	37.29	0.42	0.18	3.71	149.08	43.7
1962	10.20	7.84	6.29	5.61	24.01	11.74	117.95	170.84	79.64	9.88	0.12	0.05	444.17	130.2
1963	0.63	2.19	3.33	2.27	4.71	12.10	19.70	98.57	32.31	0.49	0.14	0.28	176.72	51.8
1964	0.66	2.80	3.30	3.69	3.89	5.40	21.02	158.05	123.80	14.62	0.12	0.10	337.51	98.9
1965	0.58	3.23	4.76	4.61	4.43	5.17	38.56	147.56	166.26	22.00	2.56	6.46	406.18	119.0
1966	10.65	7.94	7.17	6.40	6.02	21.83	60.81	108.26	28.79	0.49	0.10	0.22	258.68	75.8
1967	1.73	3.67	4.50	4.02	2.70	9.87	32.61	108.66	135.62	17.72	0.47	1.97	323.74	94.9
1968	3.71	4.91	5.65	5.80	4.81	7.57	24.91	177.29	179.77	11.47	2.29	0.53	428.71	125.6
1969	3.35	5.60	5.86	6.73	6.51	9.11	70.35	164.83	67.53	11.57	0.38	0.54	352.36	103.3
1970	4.78	7.01	6.04	5.80	6.96	8.59	31.22	216.12	166.49	13.78	0.45	1.58	468.82	137.4
1971	5.73	7.09	7.37	7.06	6.14	13.44	89.02	185.66	188.21	15.61	0.45	1.22	527.00	154.4
1972	4.18	5.14	5.09	3.36	8.73	30.20	58.16	115.84	89.81	1.96	0.50	0.71	323.98	94.9
1973	4.03	6.73	7.45	7.65	17.67	12.50	14.15	201.51	148.92	24.78	2.78	1.02	449.19	131.6
1974	2.52	5.29	5.79	5.42	8.52	16.17	52.89	234.82	136.11	13.59	1.05	0.21	482.38	141.4
1975	2.04	3.27	4.25	6.55	4.90	6.57	23.94	146.05	175.26	47.88	1.38	0.33	422.42	123.8
1976	3.50	6.70	6.20	5.40	7.14	6.83	32.25	134.42	79.80	7.94	0.50	0.32	291.00	85.3
1977	2.65	4.29	2.62	3.08	4.90	2.58	17.69	24.72	14.19	0.36	0.09	0.04	77.42	22.7
1978	2.17	5.71	5.71	5.28	7.77	12.63	43.79	143.59	171.69	26.83	0.67	0.24	426.08	124.9
AVERAGE	3.64	5.07	5.15	4.99	6.09	10.86	47.69	142.49	102.49	10.69	1.06	1.02	341.25	
STD DEV	2.90	1.75	1.32	1.27	3.79	5.65	25.82	51.29	54.30	12.46	1.72	1.33	112.58	
CV (%)	79.51	34.54	25.60	25.40	62.31	52.06	54.14	36.00	52.97	116.55	161.91	130.40	32.99	
% ANNUAL	1.07	1.48	1.51	1.46	1.78	3.18	13.98	41.76	30.03	3.13	0.31	0.30	100.00	

LITTLE SNAKE RIVER NEAR LILY, COLORADO
GAGE 09-2600 DIXON PROJECTED STAGE I DIVERSIONS
ALL VALUES IN THOUSAND ACRE FEET (UNLESS OTHERWISE NOTED)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL	PCT OF AV ANN
1940	2.00	2.79	2.17	1.35	2.65	13.81	49.96	134.34	43.09	0.46	0.25	1.74	255.21	66.5
1941	12.40	4.17	2.14	2.45	3.10	20.77	46.31	178.61	72.01	5.35	32.85	8.65	388.81	101.3
1942	19.82	14.37	10.96	7.24	6.20	27.45	107.03	135.42	114.77	10.67	0.24	0.02	454.19	118.3
1943	2.95	4.17	2.90	4.05	5.13	14.11	73.25	83.52	132.19	8.70	2.62	0.40	334.00	87.0
1944	1.05	3.92	4.49	3.99	4.16	7.78	36.99	147.60	159.44	14.73	0.42	0.00	384.57	100.2
1945	4.69	3.47	4.79	4.06	5.00	9.83	38.08	161.76	171.75	50.10	13.07	4.36	471.16	122.7
1946	0.28	8.07	5.25	4.24	7.70	19.97	89.01	110.22	60.33	4.16	3.06	0.26	318.55	83.0
1947	7.43	10.64	5.59	4.13	5.24	32.84	57.42	190.71	110.56	21.13	5.15	7.13	459.97	119.8
1948	10.88	8.39	4.42	3.68	3.44	5.22	37.94	139.27	59.56	6.17	0.15	0.00	279.12	72.7
1949	1.32	5.99	7.03	6.98	6.53	15.24	79.32	218.12	162.78	24.04	1.24	0.56	529.15	137.9
1950	11.87	7.49	6.22	4.79	4.43	17.49	69.59	156.20	137.74	17.58	0.69	0.95	435.04	113.3
1951	3.24	6.04	4.50	3.72	8.06	14.71	35.45	118.40	63.03	9.97	0.89	0.22	288.23	75.1
1952	11.91	5.48	4.96	4.36	4.77	5.43	193.66	292.73	170.10	14.50	7.55	1.85	720.30	187.7
1953	1.59	3.03	3.99	4.60	4.17	18.94	25.60	86.41	105.99	5.14	3.68	0.14	263.58	68.7
1954	0.52	5.01	4.44	4.62	6.56	13.26	52.52	67.14	17.12	1.56	0.01	2.42	175.78	45.8
1955	2.78	3.72	4.16	3.49	3.27	16.73	34.87	96.34	54.61	4.73	3.58	0.15	228.43	59.5
1956	0.18	4.12	8.97	7.08	5.14	76.24	69.49	157.80	68.33	2.36	5.04	0.03	404.78	105.5
1957	0.93	3.73	3.32	3.61	4.45	12.89	35.15	146.36	211.95	67.07	7.93	2.66	499.56	130.1
1958	0.35	8.89	6.06	5.78	9.17	18.96	46.11	214.92	95.40	4.22	0.35	0.98	417.79	108.8
1959	1.70	3.09	3.75	3.57	4.59	15.55	25.02	67.28	57.02	8.89	3.95	16.09	211.16	55.0
1960	10.51	9.58	5.24	3.12	3.91	9.27	87.42	92.10	69.97	3.24	0.17	0.25	294.78	76.8
1961	2.95	2.58	2.68	2.24	3.00	17.13	19.00	60.36	44.90	0.29	0.59	3.39	158.21	41.2
1962	12.91	9.40	9.51	8.54	25.10	77.46	157.95	165.04	80.71	15.13	0.37	0.01	562.13	146.4
1963	0.84	3.12	3.61	2.81	6.86	14.27	28.72	87.72	42.24	1.08	4.68	3.37	199.32	51.9
1964	9.43	3.01	2.42	3.13	3.28	4.94	23.17	140.75	110.50	17.86	1.32	0.25	311.06	81.0
1965	0.35	4.46	6.29	5.06	5.29	11.75	56.93	155.89	158.26	37.22	10.93	18.67	471.70	122.9
1966	13.72	8.64	7.96	8.30	5.35	68.81	59.68	93.18	34.95	1.70	0.23	0.00	302.52	78.8
1967	3.33	3.96	5.44	3.87	4.45	20.97	31.16	101.10	133.14	27.24	1.89	3.49	340.04	88.6
1968	4.01	3.66	6.38	6.23	7.35	16.13	35.15	173.77	188.94	22.21	5.80	1.71	472.14	123.0
1969	5.59	6.24	5.61	5.55	4.83	26.38	87.95	161.27	72.44	18.03	1.85	2.56	398.30	103.8
1970	9.07	8.02	5.26	5.75	10.54	14.79	38.71	211.82	173.01	28.18	2.61	3.72	511.48	133.3
1971	11.21	9.93	8.16	8.64	8.82	37.60	95.35	203.42	210.21	35.54	1.52	3.30	633.70	165.1
1972	7.55	6.73	9.46	8.59	24.38	46.21	47.94	101.72	93.50	6.27	0.41	0.15	354.92	92.5
1973	4.49	9.07	6.50	6.15	5.03	7.80	63.10	216.63	146.08	35.65	6.67	4.98	512.15	133.4
1974	5.98	9.57	8.10	6.50	6.25	11.58	63.22	250.87	146.89	16.98	2.93	0.40	529.57	138.0
1975	3.46	6.18	4.81	4.36	5.34	15.09	24.33	156.55	146.05	46.07	7.30	4.53	424.09	110.5
1976	5.40	7.97	8.53	7.62	18.99	25.76	38.81	142.96	96.60	18.03	4.15	0.53	375.35	97.8
1977	4.59	3.82	2.47	2.33	3.27	7.13	23.53	30.60	17.36	4.81	0.81	0.26	100.98	26.3
1978	1.25	2.91	8.30	7.00	8.09	31.46	50.86	157.27	184.69	38.12	4.34	4.01	498.31	129.8
AVERAGE	5.72	6.13	5.58	4.98	6.77	21.58	57.33	143.75	108.67	16.80	3.88	2.67	383.85	
STD DEV	4.89	2.85	2.26	1.94	5.10	17.78	36.01	55.86	54.39	15.71	5.70	4.06	134.92	
CV (%)	85.57	46.49	40.52	39.00	75.35	82.40	62.81	38.86	50.05	93.51	146.84	152.04	35.15	
% ANNUAL	1.49	1.60	1.45	1.30	1.76	5.62	14.93	37.45	28.31	4.38	1.01	0.70	100.00	

YAMPA RIVER BELOW CONFLUENCE WITH LITTLE SNAKE RIVER
GAGE 09-2510 PLUS 09-2600 MINUS PROJECTED STAGE I DIVERSIONS
ALL VALUES IN THOUSAND ACRE FEET (UNLESS OTHERWISE NOTED)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL	PCT OF AV ANN
1940	21.30	17.09	12.12	10.83	16.99	48.42	193.46	507.94	237.29	24.51	4.82	7.18	1102.55	76.4
1941	33.59	22.74	17.41	16.07	19.52	60.08	138.30	629.81	312.21	55.23	53.72	20.04	1378.72	95.5
1942	60.02	42.57	35.01	28.34	25.37	77.57	345.63	496.62	443.47	69.23	14.14	5.00	1642.97	113.8
1943	13.46	18.69	15.70	15.60	18.67	60.41	263.05	320.22	402.29	78.96	22.51	8.98	1238.74	85.8
1944	13.59	19.41	17.57	16.18	14.81	33.24	127.18	601.70	565.84	213.23	69.31	24.20	1716.26	118.9
1945	23.14	27.05	21.44	18.23	26.03	59.65	304.44	329.16	286.81	46.96	19.12	9.15	1171.18	81.1
1946	29.90	35.21	25.22	17.98	20.20	108.63	221.26	683.92	428.57	139.98	37.54	23.70	1772.11	122.7
1947	32.54	34.89	42.78	41.17	40.46	62.05	232.96	591.71	298.98	57.41	19.75	5.76	1460.46	101.1
1948	17.49	22.50	22.90	22.37	22.52	58.98	271.14	641.07	596.04	144.42	21.78	11.12	1852.33	128.3
1949	35.90	27.39	21.72	19.86	19.81	45.04	202.79	427.22	464.68	95.83	14.12	12.31	1386.67	96.0
1950	16.63	23.14	20.97	18.15	22.94	47.47	145.60	447.50	398.12	118.15	30.08	12.98	1303.73	90.3
1951	35.48	21.28	17.41	18.35	19.28	24.25	433.82	809.60	645.15	87.61	40.85	16.28	2169.36	150.2
1952	13.54	15.41	17.64	19.20	16.36	43.57	97.85	306.66	468.60	56.64	28.05	6.22	1089.74	75.5
1953	9.83	21.34	16.06	19.20	21.60	36.72	155.43	275.16	100.81	18.32	7.49	13.29	695.31	48.1
1954	26.01	19.98	16.71	15.91	13.89	44.76	154.30	397.26	255.84	35.68	18.81	4.15	1003.30	69.5
1955	8.35	19.74	28.78	24.14	19.30	106.33	283.80	559.24	328.13	35.51	22.25	3.85	1439.42	99.7
1956	8.18	16.38	14.82	16.29	17.47	41.63	160.29	587.20	893.23	425.41	72.64	29.44	2282.98	158.1
1957	35.17	37.62	31.53	25.98	37.15	60.43	207.81	763.76	424.55	38.89	11.27	10.77	1684.93	116.7
1958	15.06	18.31	16.99	17.11	19.12	37.07	114.24	330.87	343.13	57.14	25.55	28.26	1022.85	70.8
1959	51.57	41.31	28.42	17.59	16.61	50.02	327.80	379.62	337.60	39.57	9.71	6.02	1305.84	90.4
1960	14.02	17.65	15.64	14.49	14.93	36.14	75.18	293.27	239.25	22.20	8.67	35.16	786.60	54.5
1961	74.65	43.14	31.25	28.33	66.40	122.50	544.94	605.00	386.23	128.52	18.49	6.74	2056.19	142.4
1962	16.34	20.20	16.91	15.90	28.54	42.95	106.94	337.99	188.42	17.46	17.92	15.22	826.79	57.3
1963	7.64	14.96	10.87	11.58	12.51	18.51	90.35	475.37	404.41	100.98	20.81	10.79	1178.78	81.6
1964	10.95	18.22	23.05	22.26	20.07	29.28	213.19	542.55	613.80	187.39	57.22	48.48	1786.46	123.7
1965	50.91	33.73	28.01	28.89	20.88	156.58	181.43	328.60	142.50	18.81	7.79	2.85	1000.98	69.3
1966	19.72	16.91	18.12	15.67	17.12	63.43	119.45	352.17	450.61	136.13	23.25	17.59	1250.17	86.6
1967	21.42	16.50	18.38	19.90	21.41	44.04	124.04	517.70	655.44	116.96	42.58	16.96	1617.33	112.0
1968	27.35	25.57	22.71	22.96	20.62	52.17	336.44	560.67	293.65	92.61	22.74	22.61	1500.10	103.9
1969	35.74	32.56	27.38	27.29	32.44	41.84	120.28	723.37	617.23	150.84	29.82	20.79	1863.58	129.1
1970	40.10	35.92	29.38	31.61	30.14	104.08	372.17	597.22	671.91	152.50	21.18	18.42	2104.63	145.7
1971	25.38	29.86	28.55	29.92	49.45	118.44	173.77	361.72	382.21	38.96	9.68	11.85	1260.79	87.3
1972	24.09	31.81	28.11	24.91	20.80	34.11	159.71	689.92	504.90	166.81	38.43	17.20	1745.80	120.9
1973	21.33	29.95	30.06	25.42	21.28	47.04	288.44	847.63	516.88	92.91	22.22	5.69	1948.85	135.0
1974	15.18	22.85	13.30	17.91	21.90	43.28	116.92	490.87	578.59	254.56	38.62	15.22	1630.20	112.9
1975	20.60	25.72	25.27	22.73	38.75	58.38	125.93	450.45	316.95	78.99	26.10	10.38	1200.25	83.1
1976	16.07	14.74	11.56	10.76	15.26	27.90	75.53	142.57	104.68	9.42	5.68	5.04	441.21	30.6
1977	12.31	14.69	18.97	20.77	23.58	65.82	248.88	557.69	718.59	222.19	36.40	15.96	1955.85	135.4
AVERAGE	25.49	25.00	22.07	20.79	23.80	58.31	206.70	498.97	421.52	100.71	26.08	14.62	1444.05	
STD DEV	15.03	8.34	7.21	6.33	10.65	30.36	106.25	163.05	176.53	82.72	16.55	9.63	435.26	
CV (%)	58.97	33.53	32.67	30.45	44.74	52.06	51.40	32.68	42.35	82.14	63.45	65.83	30.14	
% ANNUAL	1.77	1.73	1.53	1.44	1.65	4.04	14.31	34.55	29.19	6.97	1.81	1.01	100.00	

Table III-11

Ideal Diversion Requirement by Stream for the Little Snake River Basin for Lands Presently Irrigated

Month	Ideal Diversion Requirement (AF/Acre)*	Diversion Requirement (AF)					
		Little Snake River (6,428.4 Ac.)	Savery Creek (2,240.4 Ac)	Muddy Creek (717.5 Ac.)	Battle Creek (376.7 Ac.)	Miscellaneous (1,393.6 Ac.)	Total (11,156.6 Ac)
May	0.12	771	269	86	45	167	1,338
June	0.78	5,014	1,748	560	294	1,087	8,703
July	1.12	7,200	2,509	804	422	1,561	12,496
Aug.	0.89	5,721	1,995	639	335	1,240	9,930
Sept.	0.25	1,607	5,604	179	94	348	2,788
Total	3.16	20,313	7,081	2,268	1,190	4,403	35,255

* U. S. Bureau of Reclamation (1977)

APPENDIX IV

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STREAM FLOWS AND SALT CONCENTRATIONS

Effects of Cumulative Depletions

Cumulative streamflow depletions as a proportion of the average annual flow at various locations on the Little Snake River and downstream are shown in table IV-1. The impacts of Stage II depletions only are also shown for comparison. On the Little Snake River near Slater, it is assumed that cumulative depletions would be the same as Stage II depletions as almost all proposed LSRWMP development is located downstream. About 12 percent of the average annual streamflow would be removed. Near the mouth of the Little Snake River, cumulative development would result in removal of about 30 percent of the average annual flow, about 6 times as much as Stage II development alone. Below the mouth of the Little Snake River, Stage II development impacts on streamflows would not be measurable using current technology while cumulative streamflow depletions would have a measurable, significant effect on streamflows all the way down the Colorado River system. The proportion of existing flows which would be depleted range from a high of 18 percent just below the mouth of the Little Snake River to a low of 3 percent above Parker Dam on the California-Arizona border.

Most cumulative depletions would occur in the upper portion of the Yampa and Little Snake River basins where waters have low concentrations of dissolved solids (generally less than 100 mg/1). In the lower Colorado River basin, concentrations are much higher (1000 mg/1), and are creating problems for domestic consumption and irrigation as well as being a sensitive issue with Mexico.

Any water removed from the upper basin has a much lower proportion of salts than the lower basin water, thus causing an increase in salinity at all points downstream. The impacts of cumulative depletions on salinity concentrations at various locations downstream are shown in table IV-2. Stage II induced salinity increases are also shown for comparison.

The salinity of the Little Snake River near Baggs would be increased about 13 mg/l by the combination of Stage II and the LSRWMP. Stage II development would account for less than one-fourth of the increase. On the lower Yampa River, cumulative development would increase salinity about 20 mg/l whereas Stage II alone would account for only about 1.5 mg/l of the increase. On the Colorado River, cumulative depletions would increase the salinity about 30 mg/l of which about 2 mg/l is attributable to Stage II development.

Table IV-1
Effects of Stage II and Cumulative Depletions
on Streamflows in Colorado River Basin

Location	Average Annual Flow (acre-feet/year)	Depletions as a Proportion of Flows (%) 1/			
		Stage II			Cumulative 1/
		Alt.B (-19,500 AF/Yr)	Alt.C (-15,800 AF/Yr)	Alt.D (-18,000 AF/Yr)	
Little Snake R. near Slater	160,380 2/	12.2	9.9	11.2	12.2
Little Snake R. near Dixon	341,250 2/	5.7	4.6	5.3	34
Little Snake R. near Lily, CO	383,850 2/	5.1	4.1	4.7	30
Yampa R. near mouth	1,567,000 3/	1.2	1.0	1.1	18
Green R. below mouth of Yampa R.	3,217,000 3/	<1	<1	<1	9
Colorado R. above Parker Dam	8,626,000 4/	<1	<1	<1	3
Colorado R. at Imperial Dam	5,700,000 4/	<1	<1	<1	— 5/

Footnotes on separate page

1/ 19,500 acre-feet/year depletion used for Stage II. Depletions for the other two alternatives would yield almost exactly the same results under the cumulative impacts scenario.

2/ 1940 to 1978 historical average flow adjusted to current level of basin development.

3/ Historical average flow.

4/ U.S. Bureau of Reclamation 1976 Modified Base.

5/ Because lower basin states have developed more than their allocation of Colorado River water, existing lower basin uses would have to be terminated in the amount of future upper basin development.

Table IV-2
Effects of Stage II and Cumulative
Depletions on Total Dissolved Solids
Concentrations in Colorado River Basin

	Dissolved Solids Concentrations (mg/l)		
Location	Existing	After Stage II 1/	After Cumulative Depletions 2/
Little Snake R. near Baggs	130 3/	133.1	142.8
Yampa R. below mouth of L. Snake R.	187 4/	188.5	206.5
Colorado R. above Parker Dam	827.57 5/	829.3	852.8
Colorado R. at Imperial Dam	1046.04 5/	1048.1	1076.6

1/ Based on dissolved solids concentration of 70 mg/l in Stage II diversions. Calculation for 19,500 acre-feet/year diversion only. Increases in salinity for other two diversions would be proportional to amount of water removed.

2/ Based on average dissolved solids concentration of 100 mg/l in diversions. Return flow contributions to salinity not included. Stage II diversion of 19,500 acre-feet/year used. Other alternatives would yield almost identical results.

3/ Typical May-June concentrations when almost all Stage II depletions would occur.

4/ Weighted average for typical year.

5/ U.S. Bureau of Reclamation 1976 Modified Base plus effects of the following four projects outside the Yampa River Basin which may be developed by 1990: Grand Valley, Paradox, and Dolores in Colorado and Las Vegas Wash in Nevada. Salinity model from which salinities computed assumes existing uses in lower basin are terminated as additional upper basin water is developed.

TABLE IV-3

Elk Habitat Loss from the Proposed Road Construction and Related Human Activity Along Open Roadways

Alternative	Miles of New Road	Acres of Elk Habitat lost to road construction due to animal displacement from human activity*		
		.25 mile	.5 mile	.9 mile
A	0	0	0	0
B	22.7	7,264	14,528	26,150
C	15.8	5,056	10,112	18,202
D	8.8	2,816	5,632	10,138

* From data presented by Ward (1980); Perry and Overly (1977); and Lyon (1979).

COMPUTATION OF COSTS

ALTERNATIVE E

Development	Cost
5000 AF Laramie County Groundwater	7,950,000
10,000 AF North Platte Water Rights	13,562,000
SUBTOTAL	21,512,000
Lake Creek	5,892,000
Lake Owen to Crow Creek	22,379,000
Delivery System	3,670,000
SUBTOTAL	31,941,000
TOTAL COSTS	53,453,000

APPENDIX V

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APPENDIX V

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Introduction

The following public comments (Part I) are representative of those received on the Cheyenne Stage II Draft and Revised Draft Environmental Impact Statements (DEIS & RDEIS). The Forest Service, in accordance with Section 1503.4 "Response to Comments" of the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, shall respond to public comment in one or more of the following ways.

1. Modify alternatives including the proposed action.

2. Develop and evaluate alternatives not previously given serious consideration by the agency.

3. Supplement, improve or modify its analysis.

4. Make factual corrections

5. Explain why comments do not warrant further agency response.

All five methods have been used in developing the Cheyenne Stage II Revised Draft Environmental Impact Statement (RDEIS) and the Final Environmental Impact Statement (FEIS).

There were 77 letters commenting on the DEIS and 165 letters commenting on the RDEIS. Similar public comments were combined into a general comment statement and answered with a single response. Those public comments and responses are contained in Part I,A.

Public responses to specific issues are addressed in Part I,B. Those that had basically the same content were reproduced as close to verbatim as possible from the letter, and a single response made to them as a group. Other comments which were not duplicated, were responded to individually in one of the five previously described methods. All comments received were either responded to individually or in summary statements.

The purpose of summarizing and combining comments was to reduce the volume of the document to comply with the CEQ regulations in Section 1500.4 "Reducing paper work", subsection (a.) Reducing the length of environmental impact statements by setting page limits, (b.) preparing analytic rather than encyclopedic environmental impact statements and (f.) emphasizing the portions of the environmental impact statements that are useful to the decision maker and reducing emphasis on background material.

In accordance with the above directives only the letters of the cooperating agencies which responded to the DEIS and RDEIS were reprinted in total. Part II of this Appendix contains reproductions of cooperating agency correspondence, highlights their comments and identifies the USDA Forest Service response.

I. SUMMARY OF PUBLIC RESPONSE

A. General Comments From Public and Forest Service Responses

Comment: The cost of the Cheyenne Stage II project is exhorbitant and unacceptable.

Response: Many of the commentors felt that there must be a better way to develop water for Cheyenne other than this $100,000,000+ proposal. There are five alternatives evaluated in the FEIS. Cost ranges vary.

Comment: Population growth projections made for the Stage II EIS are probably too high.

Response: The population projections for the FEIS were computed using the 1980 census data. There are three population ranges used: a high, a low, and a midpoint. For the FEIS a midpoint population projection range was used in computing need and term of water supply.

Comment: There is question as to whether or not there is justification for Stage II in light of the past consumption and the population projections forecast for Cheyenne.

Response: No decision as to whether or not the city needs the water has been made by the Forest Service. The decision the Forest Service will make, using the data in the FEIS will be whether or not National Forest System land would be available for the proposal and the necessary mitigation or protection measures included in an Occupancy Permit, should the land be made available for the project.

Comment: The development of the proposal will ruin the wilderness characteristics of the entire area.

Response: The decision that was reached in the supplement to the Final Environmental Impact Statement for Huston Park in 1978 was that the area IV which contained 5,210 acres would be managed either as wilderness or as nonwilderness depending on the outcome of Cheyenne Stage II proposal. The impact this particular proposal would have on other wildernesses proposed within the area has been determined to be minor. The amount of wilderness available for inclusion into the National Wilderness Preservation System varies according to alternative. There is a discussion in Section 8 of Appendix IV of the RDEIS as to the anticipated effects that could occur to proposed wildernesses in the Sierra Madres.

Comment: The Forest Service has no right to deny permits for the development of the area from Roaring Fork and Sherard Creek.

Response: The Forest Service is responsible for the management of the land involved with this proposal. Alternative C was the preferred alternative because it provided far more consistent management of all the resources in the proposal area while allowing development of the majority of Cheyenne's proposal. Development of the permits is not denied, but if water is developed on National Forest System lands then restrictions on the development would be necessary to protect the associated renewable resources. Cheyenne still has the option to develop the water off National Forest System land.

Comment: All of the information was not made available to the public.

Response: All documents related to the DEIS, RDEIS, and FEIS are available to the public. There is a public information file which contains 60 documents used in the EIS process. There were numerous scoping and other public meetings held to allow the public an opportunity to ask questions and have these questions answered. All of the public meetings and a list of the available documents are in the DEIS, RDEIS and FEIS.

Comment: The Forest Service is reducing the Stage I project by requiring instream flows.

Response: More water would be required to bypass Stage I diversion structures than at present, and therefore less would be collected. The overall proposal (Stage I & II) would ultimately increase the total amount collected.

Comment: The Forest Service should approve Stage II.

Comment: The Forest Service should not approve Stage II.

Response: The approval or disapproval of the use of National Forest System land for construction of Stage II facilities is the responsibility of the Regional Forester; Rocky Mountain Region. His decision will consider the entire scope of the information contained in the Final Environmental Impact Statement (FEIS) including all comments relating to it. The decision on Stage II will be published as the "Record of Decision" which will be filed with this FEIS.

Comment: The Forest Service does not have the right to reduce the amount of water applied for by the City of Cheyenne.

Response: The Forest Service is not attempting to usurp the State water rights. The goal in requiring maintenance streamflows is to maintain productivity of the Forest ecosystems. Riparian habitats and stream channel character cannot be maintained without water.

The City can develop their entire water right, but if they desire to do so on National Forest System land, it must be done in accordance with the management policies of the Forest Service. Should they desire to develop all of the water, they are perfectly free to do so on lands other than those which are under Forest Service jurisdiction. The position of maintaining streamflows is stated in the Chief of the Forest Service memorandum dated 8/2/78 in Appendix II of the Final Environmental Impact Statement.

B. Comments on Specific Issues [1/]

1. Alternative Water Sources to Stage II

Comment 1-D-0051: Many conservation measures can and will have to be implemented in the west. It is also our request that alternatives to this project be explored more fully, especially the alternatives of water conservation and recycling.

Comment 2-D-0034: The DEIS summarily rejects the alternative water conservation in a single sentence, thus the DEIS clearly unjustifiably ignores such important and feasible alternatives as the purchase of available land and rights to more than 100,000 acre/feet of water not only in the North Platte river valley but also near the City of Cheyenne.

Comment 3-D-0041: It should be noted that a second independent study not considered in this EIS found conservation and rationing a very satisfactory alternative should this alternative not be reevaluated.

Comment 1-R-0003: Some alternatives have not been adequately considered, they are: A. Purchase of agricultural water was too readily dismissed being against State desires to use Wyoming water in Wyoming and maintain use of existing amounts in Wyoming agriculture; B. Conservation and recycling are not being actively

[1/] Comments with a code containing the letter D were made on the original Draft, while those with code letter R were made on the Revised Draft Environmental Impact Statement.

pursued by the Cheyenne Board of Public Utilities; C. Accurate information does not seem to be available on groundwater development alternative.

Comment 2-R-0007: Why not purchase agricultural water rights?

Comment 3-R-0010: We would like to see the Forest Service examine an alternative that would/combine many of the choices that were eliminated because they were looked at as individual parts and not as a possible whole.

Comment 4-R-0012: Information on the Casper Formation around Cheyenne needs to be obtained. The potential of this aquifer in this area is not known. The Forest Service should not grant permission for construction on the project until the potential of that particular aquifer is determined.

Comment 5-R-0012: Cheyenne has the potential to conserve 50% of its present water supply through the use of inhome water saving devices and better lawn watering practices.

Comment 6-R-0027: Cheyenne has not adequately investigated the possibility of the purchase of water rights from ranches such as Laramie and Casper have recently done. Nor have they fully explored maximizing the efficiency of the present Stage I system.

Comment 8-R-0030: Alternatives that appear to be potentially viable include agricultural water right acquisition, groundwater development, conservation including possible recycling for watering of parks and similar uses.

Response: The alternative of water conservation was more thoroughly investigated in the RDEIS. The discussion of water conservation is in Chapter II, of RDEIS. It has also been discussed in this FEIS, Chapter II. In addition, it has been added to Alternatives B, C, and D. The potential results of water conservation are displayed in Graph II-1 and the table summarizing Environmental Impacts in Chapter II of the FEIS. These show the time that a given amount of water could last Cheyenne under various population projections. Conservation is combined with the development of groundwater and the purchase of agricultural water rights in Alternative E.

Comment 4-D-0052: I take particular exception to your statements on pages 38, 39 and 120 that water recycling is not technically feasible and that water conservation and rationing will not meet demands.

Response: In the RDEIS and FEIS water recycling and water conservation data were evaluated. In the FEIS water conservation was included as part of Alternative E.

Comment 5-D-0065: As a final consideration, have the authorities who authored the Stage II proposal really considered all of the alternatives? Has full consideration been given to more extensive use of wells; of purchasing other water appropriations; of imposing eminent domain over other water?

Response: The proponents of Stage II have stated at public meetings prior to the development of the Environmental Impact Statement and subsequent meetings that they have, in fact, explored many other alternatives and have found Stage II to be the most economical and beneficial to the people of Cheyenne. Other sources of water were more thoroughly explored in the RDEIS and the FEIS Chapter II. The use of eminent domain or condemnation of rights has not been considered.

Comment 6-D-0013: The Colorado Council of Trout Unlimited recommends that no permit be issued for the development without the following guarantees: (1) The City of Cheyenne institute serious conservation practices and (2) That the water not be supplied to Cheyenne in lieu of otherwise potentially available water which would be available to supply a coal slurry pipeline.

Response: The conservation practices currently being instituted by the City of Cheyenne are in Chapter II of the RDEIS and FEIS. There are also other suggestions for conservation practices which could be implemented found in Chapter II of the RDEIS and FEIS.

The water formations which would most likely supply Cheyenne with groundwater are not the same formations which are currently being discussed as being available to supply the coal slurry pipeline. The Ogallala, Arikaree and Casper formations are the ones within range to economically or even feasibly supply Cheyenne with water. The Madison formation which is being discussed as a possible water supply for coal slurry pipelines is much deeper than either formation and is not considered as a source for Cheyenne.

Comment 9-R-0002: I don't believe that the availability of water from underground sources Madison or Casper formation has been adequately investigated.

Response: The Madison Formation was not investigated in this report, however, the Casper Formation was. It is discussed in Chapter II of the FEIS.

Comment 10-R-0081: Recycling does not take into consideration the impact on existing water uses of Crow Creek downstream from Cheyenne who rely in part on Cheyenne's return flow.

Response: The downstream use is recognized and under the discussion of recycling in the FEIS, it is pointed out that recycling should apply to Stage II water only since Stage I water already has downstream demands placed upon it.

Comment 11-R-0012: Cheyenne's decreasing flat rate water selling schedule charges less per gallon the more that water is consumed.

Response: Currently this is the situation. Other rate schedule possibilities are discussed in Chapter II, FEIS.

2. Increased Stream Flows

Comment 1-D-0002: We recommend including information on flood potential of Hog Park Creek and streams in the Crow Creek drainage receiving increased flows from the proposed inner basin transfer. It is noted that these streams are now flowing at bank full capacity during spring runoff.

Response: The information on flood potential is found in Document 28, Appendix I to the RDEIS. The Cheyenne Stage II study data for watersheds are on file in the Medicine Bow National Forest office in Laramie, Wyoming. Reference is also made to the high flow in Document 29, which is the study data on fisheries, and it is referred to in Fisheries, Section 2, Appendix IV to the RDEIS.

Comment 2-D-0006: We again strongly urge that additional water be augmented to South Crow Creek to offset fishery losses. If necessary, these augmented flows could be restricted to low flow periods and to quantities which would not exceed the capacity of the City's existing collection system.

Response: The augmentation was changed to South Fork of Middle Crow Creek and is included in the RDEIS as a mitigating measure for alternatives B, C, and D. This was changed since South Crow Creek is off the National Forest System lands. The wording of the augmentation process is on page 63 of the RDEIS. Both discussions are in accordance with the Fish and Wildlife Coordination Report, Appendix II, Section 10, to the RDEIS.

The augmentation of water in the South Fork of Middle Crow Creek is currently being objected to by private landowners whose lands are traversed by this creek. In

the past, they have had problems with beavers building dams and flooding their crop and meadow lands during certain times of the year. Over the years they have been able to eliminate this problem and do not wish to have it occur again. The Forest Service, Fish and Wildlife Service, and the Wyoming Game and Fish Department are now negotiating with the landowners to devise an acceptable means of migitating the losses and augmenting stream flows at points where it will not impact ranchers on the lower Crow Creek system.

Comment 1-R-0164: Pages 75, 79, 83, 122 and 131. On these pages, reference is made to the Lake Owen-Pole Mountain pipeline terminating at the east boundary of the Medicine Bow National Forest on Pole Mountain. If this is the case, the environmental consequences of allowing water to flow through 2 to 4 miles of natural drainage to the city reservoir should be addressed in the Final EIS.

Response: The method of delivery, beyond the National Forest boundary, has not yet been decided. There is a possibility that it may flow through a pipeline for the entire distance to Crystal Reservoir which stores Cheyenne water. There are negotiations going on with landowners below Pole Mountain regarding their desires on the best possible delivery method of water from that point.

Comment 2-R-0011: A pipeline between Pole Mountain and Granite Reservoir is irresponsible economically and practically. The Stage II water can be released to the Crow Creek streams in gradual increasing amounts each year as the City's demand increases.

Response: It has been determined by the specialists of the Forest Service, Wyoming Game and Fish Department and the Fish and Wildlife Service, that the streams which now carry Stage I water on Pole Mountain cannot be increased by the amount that would be transported under the Stage II system. This is the reason for the recommendation of a pipeline to carry the water off the National Forest.

3. Decreased Stream Flows

Comment 1-D-0051: The effects of the decreased flow between the confluence of Douglas Creek and the Encampment River should be evaluated as completely as possible prior to any decisions being made on further diversions.

Comment 2-D-0010: The North Platte River in Wyoming is a major blue ribbon trout stream and popular float water of national recreational significance. The substantial reach of the North Plate between the mouth of Douglas

Creek and its confluence with the Encampment River would be diminished in water supply by diversion of Douglas Creek.

Comment 1-R-0125: Secondly, my greatest concern about the water development proposal is the potential it has for irreparable damage to the streams involved, namely Douglas and Lake Creeks and the Encampment River.

Response: Were Stage II to be developed, there would be no decreased flow between the confluence of Douglas Creek and the Encampment River, with the North Platte River. A condition of Stage II in regard to maintenance flow is that Douglas Creek be augmented to the point where it will produce 5.5 cfs below the diversion structure. Currently there is a 1.0 cfs bypass required. This requirement is found in Section 2, Appendix IV, RDEIS. Overall, the flow between the confluence of Douglas Creek and Encampment River with the North Platte, would increase by 4.5 cfs. This, however, would occur only during the low flow period and not during the spring runoff. Maintenance flows will be included in the Land Occupancy Permit if one is issued to Cheyenne for the Stage II proposal.

Comment 3-D-0010: A large and important trout stream Douglas Creek, virtually would be dried up by the Stage II proposal, its trout fishery would suffer and the wilderness character of the proposed Platte River wilderness would be destroyed or impaired.

Comment 4-D-0053: A very significant increase in the continuous release amount into Douglas Creek is recommended, 5.5 cfs, as opposed to the .05 cfs in Stage I. How do the normal flows compare with the recommended value? What years were used to calculate the mean flows, and how representative are they of the long-term averages and variabilities?

Comment 2-R-0115: We are concerned that the Stage II water project will further endanger the flow in Douglas Creek. Even now, the flow is not maintained as the law required.

Response: Currently, there is 1.0 cfs passing the diversion structure on Douglas Creek for Stage I flows. The 5.5 cfs is lower than a normal flow for approximately six to seven months and higher during the normally dry months. With the development of Rob Roy Reservoir, the normal situation in Douglas Creek no longer occurs. The 5.5 cfs was established as a minimum needed to maintain an adequate fishery in the stream similar to that existing prior to the development of Stage I.

References are available in respect to the data base years used to calculate mean flows and their representative averages and variabilities. These records can be found in Document 15 of Appendix I (RDEIS), Instream Flow Determination for Streams Affected by Stage I and Stage II, Dennis M. Jespersen, 1980. This report is on file at the Medicine Bow National Forest office, Laramie, Wyoming. These reports were updated in 1981.

Comment 5-D-0066: On page 23 of the DEIS, why even mention that Stage I diversions have insufficient water quantities to maintain viable fish populations?

Response: A major concern are the streams in the Sierra Madre Mountains, North Fork of the Little Snake. Ted Creek and Green Timber Creek historically contained a species identified by the State of Wyoming as "sensitive", the Colorado River cutthroat trout. The North Fork drainage is considered important in the survival of this subspecies. The Stage I diversions are reducing habitat and fish populations in the North Fork drainage and consideration needs to be given to correcting this situation.

Also, the Forest Service is concerned with reduced fish populations in Douglas Creek as the result of the Stage I. They are not asking that Stage I water be augmented but that 4.5 cfs of Stage II water be augmented if the proposal is developed. Background data is found in the 1979 and 1980 reports by Dennis Jespersen in Appendix I, RDEIS.

Comment 3-R-0142: Cheyenne should not be required to supplement streamflows from supplies of stored water. The migitation requirements were not part of the original project Stage I and should not become retroactive. Cheyenne also should not be required to maintain a greater streamflow than that of a normal streamflow.

Response: The Forest Service feels that undue damage is being incurred onto the environment as a result of the lack of streamflows in the Stage I system. The type of permit which regulates the Stage I system would allow for changes in the current system to bring it up to the present standards of the Medicine Bow National Forest. Current direction is for the protection and maintenance of stream channel characteristics and riparian vegetation, neither of which are being maintained along the Stage I streams where creek beds are dry.

None of the recommended maintenance flows in Stage I or Stage II streams are in excess of normal streamflow over an annual flow cycle.

Comment 6-D-0033: The Board and the City question the method by which the Forest Service is determining minimum flow requirements on Stage II streams. These determinations appear to have been made in an extremely high flow year and appear to be unnecessarily high for that reason.

Response: The calculations and field studies are done in accordance with approved methodologies and survey techniques. The process is in the Jespersen (1980) report previously referenced.

Comment 7-D-0002: This statement should assess the impacts of the proposed diversion or recharge to aquifers on the western slope of the affected area.

Response: Much of the aquifer recharge on the west side of the Continental Divide, as on the east, occurs during spring runoff. The drainage basins affected by the Stage II proposal below the diversion structures are considered adequate during a heavy snowmelt. There could be a problem in years with very little snowpack and low runoff, however that possibility exists with or without the Stage II development.

The rural and municipal water supplies on the western slope are primarily fed through the Little Snake River System. There is little dependence on the aquifer for domestic water supplies.

Comment 4-R-0164: The impacts of stream flow alteration on Douglas Creek to the quality and quantity of float boating activities on the North Platte River, outside of the National Forest boundary should be addressed.

Response: As a result of Stage II, Douglas Creek would be augmented by 4.5 cfs. The augmentation would benefit only during the low flow periods. There would not be any impact from this additional water during high flow runoff periods which is the time that most floating takes place on the North Platte River. The only activity during the high runoff float boating period would be the collection of water in the Rob Roy Reservoir. Compared to the current situation, the fluctuation or change from the current situation should be around 2 to 3% less than currently flows down Douglas Creek into the North Platte during the high flow period.

Comment 8-D-0019: With regard to the DEIS recommendation for reduced amounts to be obtained from Stage II and the recommended requirement by the Forest Service for additional fish maintenance flows from Stage II, I ask the question, why is not the previous agreement between the City and Wyoming Game and Fish Department to release

approximately 4500 acre-feet/year to guarantee minimum and flushing flows sufficient?

Comment 9-D-0067: The Forest Service also proposes to reduce the amount of water Cheyenne is entitled to in the Stage II system. The reduction would be below the level negotiated by the City and the Wyoming Game and Fish Department.

Response: During the data collection period of the development of Cheyenne Stage II EIS, additional streams were found to have viable fish populations. In order to maintain these fish populations, protect riparian habitat and stream channels, additional flows will be required. These streams were not identified in the original agreements between the Wyoming Game and Fish Department and Cheyenne.

Comment 10-D-0029: We are concerned that the adverse environmental impacts on the west slope (primarily, with respect to water-flow loss) and on the east side of the Continental Divide (with respect to destruction of both terrestrial and aquatic wildlife in the Medicine Bow National Forest, and also with regard to indirect growth induced impacts on the City of Cheyenne) are not adequately disclosed.

Response: Your concern is valid. The Fisheries and Wildlife sections of the RDEIS and FEIS have been supplemented. See Chapter IV in both statements. The scope of the growth induced impacts on the City of Cheyenne have not been discussed in detail because suitable data were not available.

4. Reservoir Fluctuation

Comment 1-D-0052: The eroded banks, bathtub rings, weedy vegetation, roads and garbage makes the area much less visually pleasing than it was prior to 1960 before Cheyenne Stage I changed the area from a pristine wildlife paradise to a playground for the owners of large motor boats.

Response: This description is in reference to the condition of the lands around Hog Park Reservoir. As a mitigation measure for all alternatives, reservoir fluctuations will be kept at a minimum during the recreation season. This is part of the condition of increasing the size of both Hog Park and Rob Roy Reservoirs. This requirement was designed to maintain the visual and recreation quality of the reservoirs during high use recreation periods.

Comment 1-R-0041: "During the period when heavy recreation use is anticipated, water levels would not fluctuate except to the extent necessary to maintain stable releases in Hog Park and Encampment River." Since the releases from present Hog Park Reservoir reduce the size of the reservoir from 175 acres to as little as 60 acres, it is clear that the quoted statement is intentionally misleading--clearly, the greater the water release requirements to compensate for Cheyenne's proposed larger takings of water from the North Platte Basin will make even a greater environmental mud pie out of the proposed larger Hog Park Reservoir during the heavy recreation season than the current 115 acres.

Response: The statement referred to is not intentionally misleading. Although there is no guarantee of actual fluctuation, the revised advance payback system from Hog Park Reservoir has been designed to take care of any massive fluctuations during the recreation season. It is true that there would be a larger mudflat exposed, but it would be exposed after the recreation season.

5. Colorado River Salinity

Comment 1-D-0074: There is a direct relationship between the magnitude of annual diversions and the resulting salinity impacts. We do not understand the EIS statement that all action alternatives would have the same salinity impact. With the variation in annual diversions the report's accuracy would be improved by correctly relating the amount of diversions to different salinity impacts.

Comment 2-D-0029; 3-D-0054: Stewart (1979) calculates the net effect of the annual removal of salt by the diversion, as well as the annual depletion of 23,000 acre-feet of water on salinity concentrations at Parker and Imperial Dams. He found that the project would increase salinity at Parker Dam by 1.43 mg/liter. Using Stewart's 1979 "base conditions" and the correct value for annual salt loading of minus 2148.24 tons, there would be an annual increase of salt at Parker Dam of 2.12 mg/l Table 1.

Comment 4-D-0050: With the reduction in water volume from the collection area in the Little Snake Drainage, salinity concentration in downstream waters will increase.

Comment 5-D-0051: Diverting some of the purest water in the Colorado River Drainage to the North Platte River Drainage will certainly affect salinity levels downstream.

Response: The salinity impacts were recalculated in the RDEIS. The salinity impacts for each alternative are in the charts at the ends of the Summary and Chapters II and IV. The salinity impacts vary from 0 to 2.17 mg/liter at Imperial Dam, California, depending on the amount of water to be diverted.

The method of calculating salinity impacts is in Appendix IV to the RDEIS. The variation in salinity impact within an alternative is dependent on the total dissolved solid content of the water at the point of diversion which is the difference between 50 mg/l as suggested by the 1980 Chris Lidstone Report and the 150 mg/l as suggested by Forest Service hydrologist Pete Stewart during his field studies of 1979. Both total dissolved solids figures were used to calculate a possible range of impacts from least to most.

The methodology and computation figures used by Stewart in redetermining the salinity impact have been reviewed and verified by the Bureau of Reclamation, Durango, Colorado office.

Comment 1-R-0095: My question on the appropriateness of Stewart's use of the Bureau of Reclamation's Savory Pothook Salinity Model have not been answered. In Appendix IV, page 7, Stewart notes that the numbers corresponding to A, B, C, etc., used in the equation are from the modified 1976 base plus four projects. Finally inbasin salinity concerns were once again ignored by the Forest Service in their preparation of the DEIS.

Response: The appropriateness, accuracy, and methodology of the numbers used in the Stewart report have been verified by the Bureau of Reclamation and the Colorado River Board of California. This commentor's calculations for salinity were submitted to the Durango office of the Bureau of Reclamation. A response was returned to the Forest Service and forwarded onto the commentor in which the Bureau of Reclamation pointed out some errors in this commentor's methodology.

Comment 2-R-0042: Summary, page viii Alternative B. paragraph two, sentence two. The salinity concentration noted should be indexed to the point of measurement. This is normally at Imperial Dam. The comment also applies to Alternative C and D.

Response: We agree. All salinity measurements have been so indexed in the FEIS.

Comment 3-R-150: In the Revised DEIS we recommend that the unit economic damages for salinity stated on page IV-77 of the Appendix is amounting to more than 300,000

mg/liter increase in salinity concentration in Imperial Dam be changed to equal the Bureau of Reclamation's current value of more than $450,000 per mg/l.

Response: We concur. The amounts agree with the figures specified by the Salinity Control Forum. The damage data has been changed to reflect this $469,000 per milligram per liter and the discussion can be found in Chapter IV of the FEIS.

Comment 4-R-0024: The RDEIS states that salinity may increase. The removal of 20,000 acre feet will increase the salinity concentration.

Response: We agree that the salinity concentration will increase with the removal of additional water from the Upper Snake River Basin. The amount of the increase varies with the amount of water which is depleted in each alternative. The range of the damage due to the salinity impact by alternative is discussed in further detail in Chapter IV of the FEIS.

Comment 6-D-0027: It appears, based on flow data sent by Pete Stewart, that the proposed diversion will result in an insignificant impact on Yampa River flows except, perhaps, in drought years during July and August. However, the lower Little Snake River will experience this salinity impact.

Response: It is true that the Little Snake River will experience an impact. The salt loading calculations have been recomputed and are found in Appendix IV p. IV-2 of the RDEIS (Stewart, 1979) Salinity Impacts on the Colorado River Drainage Caused by the Stage II Cheyenne Diversion was updated in 1980 and on file at the Supervisor's Office, Medicine Bow National Forest, Laramie, Wyoming.

Comment 7-D-0054: The projection of estimated damage due to increased salinity at Imperial Dam is $300,000 per milligram per liter increase in salinity. Due to errors in projecting salinity increases, the minimum acceptable salinity increase is 6.96 mg., not the 1.73 mg. on which the DEIS is based.

Comment 8-D-0054: The Lidstone study proves the actual depletion at the mouth of the Little Snake will be at least 7.5% rather than 5.5% that Pete Stewart of the Forest Service projected from irrelevant data.

Comment 5-R-0089: It appears to me that the downstream increase salinity of the water would not be sufficient to be a problem and any increase is strictly a supposition not based on fact.

Response: The calculations have been revised in the Final EIS. The figures verified by the Colorado River Board of California and by the Bureau of Reclamation, Durango Office are considerably less than 6.96 mg/l increase. Chapter IV of the FEIS contains the revised data. Depending on the alternative, the annual damage rates could range from $0 to $1,017,000 (Bureau of Reclamation, 1980).

Comment 6-R-0041: In spite of our and other comments to the May 1980, DEIS that pointed out the inadequacy of the data used to determine the increase in salinity that will be caused by any diversion on the North Fork and the improper interpretation of correlative salinity data, the Revised DEIS pretends the salinity issue does not exist. Instead, it finds that at worst, there will be only 1.53 to 1.76 mg per liter of salt increase as a result of Stage II. This finding not only has no foundation in fact, but it ignores the available evidence of streamflow and salinity data of the U.S. Geological Survey cited by Mr. Lidstone in his July 10, 1980, study which he furnished to the Forest Service as comment on the May 1980, DEIS.

Response: The data gathering methodology and the interpretation of the Forest Service salinity data has been supported by the report issued by Errol Jensen of the Bureau of Reclamation, Durango, Colorado. It has also been supported by the Colorado River Board of California as not being in conflict with the agreements of the Salinity Control Forum on the Colorado River.

6. New Access Into Unroaded Areas

Comment 1-D-0051: The DEIS does not address the severe impacts that could occur because of roads and pipelines through or near critical habitat of the diverse wildlife populations in the area. The DEIS does not reveal whether or not the pipelines and/or associated roads pass through or near critical habitat such as elk calving areas.

Response: The wildlife resource discussion has been expanded and the impacts reevaluated. The new material is in Chapters II and IV in both the RDEIS and FEIS. Additional data is available in the Medicine Bow National Forest Supervisor's Office in Laramie, Wyoming, including Document 31, EIS Stage II Study Data-Wildlife and in Document 37, Fish and Wildlife Coordination Report.

Comment 2-D-0055: Why aren't you closing the road to West Branch?

Response: If Stage II becomes a reality, road closures would be decided at a later date. At this time, it is planned that all new access roads on the west side of the Continental Divide would be closed during construction, except for the administrative use. Future road use would be decided in the Medicine Bow Land and Resource Management Plan.

7. Fish Habitat

Comment 1-D-0051: I would note that the total trout habitat unit figures listed on pages VIII-30, VIII-31, and VIII-32 do not concur with those figures in Table A, page VIII-40.

Response: The correct figures for trout habitat units are in Appendix IV to the RDEIS.

Comment 2-D-0050: When Stage II expansion in the West Branch of the North Fork of the Little Snake River drainage depends on the implementation of recommended instream flows, flushing flows, and blanket minimum flows, how can a proposal state with any sense of integrity, that existing fish habitats will be maintained at present levels?

Response: The limiting factor on fish habitat or on fish populations is the low flow period. The maintenance flow requirement for the Stage II will, at a minimum, provide the current low flow requirements. In Stage I streams the increase would be to the historical period of low flows and would improve the fisheries to that level.

Comment 1-R-0041: The massive nature of the proposed Stage II construction area not only will affect the watershed past the West Branch but will kill all Colorado cutthroat trout below the construction areas in violation of NEPA.

Response: There is expected to be some temporary impact on the Colorado River cutthroat trout should construction occur. However, there will be coffer dams and settling ponds required to catch and trap the silt which is generated during the construction process. Once the system is in operation, it would stabilize and from that point on would not impact Colorado River cutthroat trout.

Comment 2-R-0001: Diversion of the headwaters of the Little Snake River would not only destroy trout fisheries but also the heart of the Huston Park roadless area which was proposed for an 80,000 acre wilderness and dry up or reduce water supplies in the Little Snake River Valley.

Response: Requiring maintenance stream flows would prevent the destruction of the fisheries and also a serious reduction of water supplies in the Little Snake River Valley.

Comment 3-R-0082: I am intrigued, however, by the apparent threat to the pure strain of the Colorado River cutthroat trout, already classified as sensitive by the Wyoming Game and Fish Department. I believe a threat to the very existence of a native trout, whether it be in Colorado or Wyoming is serious cause for concern.

Comment 3-D-0013: The Colorado Council of Trout Unlimited recommends that no permit be issued for the development without the following guarantees. (1) That full fish and wildlife mitigation become project features and (2) That special steps be taken to protect the Colorado cutthroat Trout.

Comment 4-D-0041: Minimum flows for all streams below the diversion structures are needed to offset the loss of a trout habitat units and to insure the continuing presence of the Colorado River cutthroat Trout.

Response: The conditions for construction, and protection measures for the Colorado River cutthroat Trout are included in the mitigation measures in Chapter II of the RDEIS and FEIS.

8. Downstream Water Users

Comment - Summary: The Revised Draft Environmental Impact Statement does not adequately take into consideration the needs of the ranchers and citizens of the Little Snake River valley.

Response: The problem with inbasin needs of the Little Snake River valley became very apparent at the public meetings which were held in Baggs, Wyoming. The root of the problem appears to lie in a case of mistrust between the citizens of the Little Snake River valley and Cheyenne in regard to past operation of their Stage I system.

Valley citizens claim that the water that they need and have under senior appropriation has not been available because in the past the CBPU has neglected to shut down their system when called on to do so. This appears to be a problem that has to be resolved in-state between the water users, the State Engineer's Office and Cheyenne. The Forest Service assumes that were the water not available and there were not conditions to protect the current water users that the State Engineer would have

never issued the permits to the Board of Public Utilities.

The needs of the downstream users of the Little Snake River valley have been considered to the extent that the Forest Service has required maintenance flows in all diverted streams so that during the low periods the existing condition will continue. The maintenance flows would not have any effect on the high period of flow when Cheyenne is taking water out of the system.

Comment 1-R-0042: The States of Nevada and Utah also have demands on larger streams supplied in part by the Little Snake, but were not listed.

Response: These states have been added to the list in the FEIS of states that depend on Colorado River water.

Comment 2-R-0024: The direct impacts of Stage II on the western slope are not thoroughly examined in this document. Removal of 20,000 acre-feet of water in the Little Snake River drainage could potentially harm the residents of that area by restricting future development of the Little Snake basin.

Response: The removal of the water and the availability for all uses downstream is a responsibility of the Wyoming State Engineer. Cumulative impacts in regard to future development is also disclosed in Chapter III of this FEIS.

Comment 3-R-0055: I want it known the inbasin impact was inaccurate and fell far short of the expectation desired in this report.

Response: The inbasin impacts, as far as needs for other uses such as oil shale developments and other future developments in the Little Snake and Colorado River system, have been updated in Chapter IV of the FEIS.

Comment 4-R-0061: Has the Forest Service and the City of Cheyenne asked the ranchers in the Baggs, Wyoming, area that they think of the proposals B or C?

Response: Yes. Although the ranchers and the residents of Baggs are not totally in support of the Cheyenne Stage II Project, several have indicated in public meetings that Alternative C is much better than Alternative B. There is a feeling that something is going to be built anyway and they would be more satisfied with the lesser amount of development.

Comment 5-R-0080: The Draft Environmental Impact Statement prepared by the Forest Service fails to include

any studies of the project's effects on the Green River Basin area.

Response: Impacts to the Green River Basin was not presented as an issue until after the RDEIS was printed. In the Appendix of the FEIS is a letter from the State Engineer which described the situation which exists regarding the impact on the Green River basin. In summary, the State Engineer specifies there is no legal requirement that the Green River basin must pay back the water which is taken from the Little Snake.

Comment 6-R-0084: Often this and other like projects will have a very negative effect on the entire string of supposedly protected National Monuments and Parks, Dinosaur, the Green River Wilderness, Canyonlands, Glen Canyon and Grand Canyon.

Response: The studies that have been made in regard to water depletions and impacts on threatened or endangered fisheries and water supply do not indicate that this project will have a severe impact on any type of downstream use or impair the areas mentioned.

Comment 7-R-0088: We are very concerned about the Cheyenne Stage II Water Diversion Project and the affects it will have on our river business.

Response: The watershed and salinity reports referenced in Appendix IV to the RDEIS do study the problem of water depletion. The anticipated fluctuation as a result of depleting from 15,000 to 20,000 acre-feet of water would reduce the high runoff water period by three to five percent. Since normal annual fluctuation during the same period is 25% the reports indicate that there would be be no serious impacts on any type of uses of downstream waters. The rivers should remain in their current status.

Comment 8-R-0126: The proposal and its Environmental Impact Statement hardly mention and do not adequately consider the effects west of the Continental Divide in Wyoming and beyond. There are farming and ranching, fish and fisheries, endangered species, downstream salinity and white water boating to be more considerately and adequately addressed.

Response: Downstream uses - primarily agricultural, mining, and industry - are described in Chapter III and Chapter IV of the FEIS. Discussions on salinity and whitewater boating can be found in Section 1 of Appendix IV to the RDEIS and in the Stewart reports on file in the Medicine Bow National Forest office.

Comment 1-D-0055: Why weren't the real needs of Carbon County Ranchers addressed in the report?

Response: Downstream needs are discussed in the Socioeconomic Evaluation of the RDEIS and FEIS in Chapters II and IV. The impact on the ranchers in Carbon County and the users of lower Snake River water in the Little Snake River Valley is a responsibility of the State Engineer. There appears to be a mistrust between the ranchers and the former operations of the Stage I system as regulated by the State Engineer's Office. This is a problem that will have to be resolved on a local level. It is outside the scope of this EIS.

Comment 2-D-0060: From the reports I have read and the figures I have seen, I don't believe it is possible for Cheyenne to take the proposed amount of water and still have enough left in any of the creeks for our ditches and water rights.

Comment 3-D-0010: Finally, the Stage II Proposal would threaten ranchers' water rights in decreased water for hay meadows and other irrigational purposes, eliminating some ranchers' domestic water supply and increasing rancher's operational cost in the upper Little Snake Drainage.

Response: The issuing and administration of water rights is a responsibility of the Wyoming State Engineer. His decision on whether or not there is enough water for the existing prior uses is in concurrence with the Wyoming State Water Law.

Comment 4-D-0002: Additionally, the impacts beyond Forest Service boundaries have not been analyzed. The special concern is how the increased and decreased stream flows would affect peak flows, streambanks, streamside vegetation, fish populations, recreation uses, and water qualities downstream.

Response: These impacts have been evaluated and disclosed in the RDEIS and FEIS. THe waterflows and variation of flows are within the normal fluctuation in these streams over the year. A discussion is in Appendix IV, Section I of the RDEIS.

Comment 5-D-0021: I believe the inbasin impact could have been addressed in more detail in this report.

Response: Inbasin impacts have been discussed in Chapters III and IV of the FEIS with greater detail.

Comment 6-D-0027: A major deficiency of the EIS is the failure to address the impacts of diversion on flows and

water rights in the Little Snake and Yampa Rivers in Colorado.

Response: The water rights and uses of those rights are covered in a 1943 Colorado River Compact for the upper Colorado River Basin. The regulation of those rights is a joint agreement between the State of Wyoming and State of Colorado.

Comment 7-D-0033: The Forest Service has addressed one issue in subparagraph I, concerning the effect on the rights of downstream users in the Little Snake River Valley. The Forest Service lacks the authority to consider and adjudicate any use along the Little Snake River Valley.

Response: The Forest Service agrees with this comment.

Comment 8-D-0033: Under paragraph B, page 23, entitled "Water", a statement is made that "a minimum of 180 cfs is being maintained at the Dixon, Wyoming, stream gauge to supply downstream uses". This is somewhat misleading because the stream flow at the Dixon gauge frequently gets below 180 cfs at present, and Stage II projects will not change that condition.

Response: The Forest Service agrees with this comment. The 180 cfs figure used in the document is an estimate made by Banner and Associates. The 180 cfs was only used as a guideline to indicate at what flow rate a requirement might be made, where water being diverted might be called on for uses downstream by appropriators with water rights senior to those possessed by Cheyenne.

Comment 9-D-0034: The significant factual omissions and errors in the DEIS include a failure to consider inbasin effects within the entire Colorado River Basin; inadequate assurance of protection of water rights of present downstream users; misleading data regarding projected water demand in Cheyenne; inadequate data on present water quantity and quality; failure to consider all reasonable alternatives; failure to consider the impacts and the significant developments in Colorado, Utah and Wyoming that are associated with oil shale development.

Response: Additional demands for other uses have been discussed in greater detail and can be found in Chapters II and IV of the FEIS.

9. Threatened or Endangered Species

Comment 1-D-0054: Mr. Blunt, in his assumption on the impact of the proposed diversion on the humpback chub, states that the maximum transmission diversion occurs during high flow and is shut off at 180 cfs.

Response: With respect to the high flow of 180 cfs, in the statement it is used only as an indicator as to what the minmum flow would be before Cheyenne would be required to stop taking water.

Comment 2-D-0056: Why are we so terribly concerned with trash fish, the humpback chub, Colorado squaw fish, bonytailed chub and razorback sucker?

Comment 3-D-0029: While mention is made of the possible effect of Stage II on known threatened and endangered species in the Yampa and Green Rivers including the Colorado squaw fish, the humpback chub, and the bonytailed chub, the actual effect of the water project on these species has not been determined.

Comment 1-R-0041: It is clear that Stage II, whether it is proposed by CBPU, or as amended by the Forest Service, will reduce the critical habitat not only of endangered species but also the Colorado River cutthroat trout.

Comment 2-R-0164: In the DEIS consultation between the Forest Service and the Fish and Wildlife Service is ongoing concerning project effects on threatened or endangered species (Colorado squawfish, bonytail chub, and humpback chub). On May 29, 1981, a biological opinion was issued which addressed survival aspects for the listed species. The final opinion will be issued not later than July, 1982, and should be consulted.

Response: These species are listed as threatened or endangered. The Forest Service as a government agency, must comply with the Threatened and Endangered Species Act and the Wildlife Coordination Act. Fish and Wildlife Service has issued a "no jeopardy" opinion. The complete opinion can be found as a part of Appendix I, in this FEIS.

Comment 4-D-0033: Paragraph E, of the DEIS describes areas of controversy. The question of the effects on endangered species downstream in the Colorado River drainage is too nebulous to justify serious consideration in the proposed Stage II project.

Response: The complete assessment of probable impacts on endangered species is contained in the June, 1981, Biological opinion issued by the United States Fish and Wildlife Service. This opinion is found in Appendix I to this FEIS.

10. Terrestrial Wildlife Impacts

Comment 1-R-0106: I feel that the Stage II water project will seriously injure the wildlife habitat and recreational usage in Lake Creek and Douglas Creek area.

Response: Wildlife habitat and recreation impacts have been explored to a greater extent in the FEIS, Chapter IV.

11. Reservoir Safety

Comment 1-R-0133: There is a constant fear for life and property in the Douglas Creek Canyon should the dam break. There have been four shocks since Rob Roy Reservoir was built and now they want to add another 60 feet on top of the dam.

Response: The seismic activity in the Rob Roy area has been studied extensively by the firm of Woodward and Clyde in Denver, Colorado. There have also been numerous engineering tests done on the proposed area which would support the additional height of the Rob Roy Dam. It appears that increasing the height of the dam is feasible and safe.

12. Development of Compact Water

Comment 1-R-0042: The institutional issue of "keeping water in Wyoming" i.e., using the Wyoming apportionment of the Colorado River in Wyoming, should be added to the list of issues addressed beginning on page 6.

Response: The issue of keeping water in Wyoming is an integral component of Issue M, "Development of Compact Allocated Water."

Comment 2-R-0043: The major drawback to any transbasin diversion from the Upper Little Snake River is that the River is covered by a subcompact in the Upper Colorado River Compact. Provisions in the subcompact are loosely worded enough to necessitate legal resolution of problems arising from the diversion of water. Further, as it now stands, the DEIS incorporates provisions for minimum stream flows which are not compatible with Wyoming State Law. To provide assurance to fishermen and downstream water users of permanent flows, probably unenforceable, is wrong.

Response: The required stream flows would be met. The Organic Act of 1897 by which the Forest Service operates provides that flows can be required in streams on National Forest System land to maintain stream channel integrity and ensure the maintenance of riparian habitats along stream sides. It is also the Chief of the Forest Service's decision that stream flows are needed, and can be required and maintained for certain conditions. These conditions are specified in the memorandum from Chief McGuire in Appendix I of this FEIS.

Comment 2-R-0011: The water belongs to the State of Wyoming and Cheyenne has a valid water right permit for the Roaring Fork and Sherard Creeks streams.

Response: The Forest Service agrees that Cheyenne has valid water right permits for these streams.

13. Water Conservation

Summary: The Revised Draft Environmental Impact Statement fails to discuss fully the potential of water conservation as an alternative.

Response: Conservation has been discussed in much greater detail in the FEIS in Alternatives B, C, D and E.

Comment 1-R-0084: Cheyenne does not have a water conservation program.

Response: Yes, they do. The program that Cheyenne is now carrying on in regard to water conservation, other methods they could use and the possible results from those methods are discussed in Chapter II of the FEIS.

Comment 1-R-0081: The projected potential for water conservation techniques is excessively optimistic.

Response: The Forest Service does not guarantee the conservation techniques listed in Chapter II of the RDEIS and FEIS. Information which indicated the results of water conservation methods practiced by other cities in the United States were disclosed. It is true that results could be quite different in Cheyenne depending on several variables, one of which is the public acceptance of this program.

Comment 3-R-0081: Line item n. needs to be modified on page xiv of the RDEIS for it cannot be accurately stated that water conservation will or will not be maximized under any alternative.

Response: Water conservation as discussed in the FEIS was revised. The potential for water conservation to be

implemented in any alternative is discussed in more detail in Chapters II and IV.

C. Comments and Responses on Issues Specific to the Draft Environmental Impact Statement

1. Wildlife Habitat

Comment 1-D-0052: Without further detailed study of the effects of the flooding on terrestrial wildlife, Stage II's ultimate effect on these animal populations is not known.

Response: The potential effects have been analyzed further and disclosed in Chapters II and IV of the RDEIS and FEIS. The protection measures are specified in the Fish and Wildlife Service Coordination Act Report, Document 37, on file at the Forest Supervisor's Headquarters, Medicine Bow National Forest, Laramie, Wyoming.

2. Payback System

Comment 1-D-0053: A system called "deferred payback: (page 36) is used, but no clarification or definition is offered. Other terms in the same sense include "early payback" and "modified release payback".

Response: The terms "deferred payback", "early payback" and "modified release payback" were intended to mean the same. The current water payback system is a "daily" system where the amount of water taken from Douglas Creek each day must be paid back from Hog Park Reservoir on the day it is taken. The above terms indicate a system where the water would be let out of Hog Park during the winter months in amounts which are equal to what Cheyenne would divert from of Douglas Creek during the following June 1, to the September 15, recreation season. Therefore, the water is paid back "early" or in advance of when it is taken which allows a higher level of water to be maintained in Hog Park Reservoir so there would be no unsightly mud flats during the recreation season.

3. Needed Permits

Comment: Needed permits should include the National Pollutant Discharge Elimination System (NPDES) issued by the Wyoming Department of Environmental Quality.

Response: This permit has been added to the list of needed permits in the RDEIS.

4. Revegetation

Comment 1-D-0002: Specification regarding the use of indigenous vegetation should be included in the mitigating measures.

Response: Species used in reclamation would be those best suited to the particular area. Exact species would be specified in the occupancy document.

5. Reservoir Depth

Comment 1-D-0053: Page 48 refers to the ability of an expanded Rob Roy Reservoir on Douglas Creek to maintain an average yield of 20,500 acre-feet. I don't know how to interpret this statement since some drought years will produce far less than this amount and the proposed reservoir certainly won't be able to store more than one year's water supply, especially in a drought year. Can you please clairfy the meaning of this statement?

Response: The reservoir's design for a holding pool is in excess of a one year capacity. The reservoir could store up to 34,000 acre-feet. Cheyenne would use about 26,500 acre-feet maximum (Alternative B). The water in the reserved pool, the wells, and the Crow Creek augmentation could carry Cheyenne through a drought period. The yield of these sources is discussed in Chapter II of the RDEIS and FEIS.

6. Matching Flow

Comment 1-D-0053: There are about 20 years of data available from Stage I operation. No summary was presented in the EIS about this operation nor the comparison of performance figures with the original design or the Stage II design figures.

Response: The operation figures and amounts delivered are available from the Cheyenne Board of Public Utilities in Cheyenne, Wyoming. The runoff data for the past years is available at Banner Engineering, in Laramie, Wyoming.

Stage II diversion structures would be designed to make them more efficient while guaranteeing maintenance flows in the streams that are to be diverted.

Comment 2-D-0065: A modified release schedule or early payback system must be implemented to ensure that washout damage to the Encampment-Hog Park fishery is precluded. It is essential that an early payback guarantee be implemented as proposed by the Draft EIS.

Response: This condition is stipulated as a required mitigation measure found in Chapter II of RDEIS and FEIS.

7. Dam Safety

Comment 1-D-0025: We have owned our cabin on Douglas Creek long enough to know that there are earthquakes in the area. Said quakes were registered in Boulder and at the weather bureau. The residents of Keystone say no one in the area knows of a flood ever occurring.

Response: The problem of dam safety, as it pertains to earthquakes and seismic disturbances in the area, has been discussed in detail in the RDEIS. A report by Woodward & Clyde (1977) is in Appendix III to the RDEIS. This report indicates that there appears to be no problem with potential seismic disturbances causing structural damage in the Rob Roy Reservoir area.

Comment 2-D-0053: How well can Cheyenne safely store the water?

Response: It is assumed that the comment refers to the Crystal and Granite Reservoirs. Much of the new water would be stored in the Hog Park and Rob Roy Reservoirs which would be enlarged to hold the additional capacity. The seismic and engineering studies indicate that there is no historical problem in safe storage of the water in the upper reservoirs.

8. Issuance of Permit

Comment 1-D-0052: I submit that no permit should be issued or granted for construction of any Stage II until the City and State get along with the Federal agencies involved, and conduct a thorough study of conservation and recycling alternatives.

Response: Water conservation was studied in more detail in the FEIS Chapter II.

9. Huston Park Wilderness

Comment 1-D-0055: Would Alternative C really leave 65,892 acres in the Huston park Area recommended as wilderness?

Response: Yes, according to calculations, 1,430 acres of Area IV within the proposed Huston Park Wilderness would be deleted from the inventoried total of 67,322 acres available.

10. Balanced Uses

Comment 1-D-0056: It would be nice to continue to have lawns, parks, golf courses and high mountain stream

fisheries, but your draft indicates that maybe we can't have it all.

Response: If the mitigation and development requirements in the RDEIS and FEIS are met, there would be water available for all uses. The amount of water available for domestic uses is dependent on the actual growth in Cheyenne.

11. Maintenance Flow Negotiations

Comment 2-D-0033: The Forest Service in Alternative B imposed additional minimum flushing flow requirements which reduced the approximate annual yield from Stage I and Stage II combined from 28,900 acre-feet to approximately 27,500 acre-feet/year. It appears that these minimum flow requirements of the Forest Service are arbitary and arrived at without thorough study of the entire situation.

Response: Recommendations for the maintenance and flushing flows used in this document were derived from a report entitled "Instream Flow Determination for Streams Affected by Stage I and Stage II" which was completed as a result of a two-year field study by Dennis Jespersen, fisheries biologist, in 1979 and 1980. Reference to this report is found on page I-6 of the RDEIS Appendix. It is also available at the Medicine Bow National Forest office. The methodology for the Calculations is found in the RDEIS, Appendix IV.

12. Archeological Survey

Comment 1-D-0002: We note, (page 36) that an archeological survey will be completed prior to any construction. We urge that the survey be planned with the assistance of the Wyoming State Historical Preservation Officer (SHPO) and that the final statement include both the survey results and documentation of the coordination with SHPO.

Response: The archeological survey would be completed after a decision has been reached as to whether or not Stage II will be built. Only the area affected would need survey instead of the entire corridor should a reduced program be initiated. This decision was reached in conjunction with the Wyoming State Historical Preservation Office and the Forest Service in a Letter of Agreement. This letter is on file at the Forest Supervisor's Office, Medicine Bow National Forest, Laramie, Wyoming.

13. Mining Claims

Comment 1-D-0002: The statement fails to recognize patented and unpatented mining claims, prospects, mines, and mineral occurrences adjacent to or within reservoir sites. No conflict is anticipated however, with existing or proposed water pipelines or collection systems.

Response: The Rob Roy and Hog Park areas were inventoried for the existence of mining claims. None were found to exist in the Hog Park Reservoir area. However, there are several mining claims below the proposed high water line at Rob Roy. There are existing claims within the pipeline construction corridor of Lake Creek. These claims are being researched by Banner Engineering. Resolution will be made prior to construction should Stage II become a reality.

14. Original Proposal

Comment 1-D-0023: Another concern of the State is the fact that Cheyenne's original Stage II proposal, as approved by the Wyoming Water Development Commission and authorized by Wyoming State Legislature, was not evaluated in its entirety.

Comment 2-D-0033: The Board and the City were very disappointed to find that the Forest Service did not even include as an alternative for consideration, the proposal made by the City of Cheyenne which was submitted to the Forest Service. The closest alternative considered by the Forest Service was Alternative B which, in reality, was significantly different from the project as proposed by the City and the Board.

Response: The reason for the rejection of the original CBPU proposal was that it did not meet the alternative formulation criteria which were designed at the beginning of the project. It did not provide for mitigation of the damages which might occur to the environment by the development of the proposal. It was, however, discussed in more detail in Chapter II of the RDEIS and FEIS. Alternative B is the CBPU proposal with the mitigation measures prescribed by the Forest Service.

15. Remaining Water Rights

Comment 1-D-0033: Another factor not addressed in the Environmental Impact Statement is the question concerning what will happen to that part of Cheyenne's water rights that the Forest Service is now denying them under Alternative C.

Response: The remaining water rights would be available for development. Where they would be developed and how, could require a future analysis, unless the rights were

developed off National Forest System land. For the interim period the water would continue to flow unobstructed in its present state.

16. Water Amounts

Comment 1-D-0033: There are several misstatements in paragraph b on page 11. These misstatements regard the amount of water produced by Cheyenne annually.

Response: All figures have been reevaluated with the Engineering Company for the Board of Public Utilities. The data and documentation found in the RDEIS and FEIS are the production figures that Cheyenne is currently using.

17. Stream Miles

Comment 1-D-0033: The Board and Engineers have accurately set the stream mileage inundated by the reservoir construction to be Hog Park Reservoir 3.6 miles, Rob Roy 3.9 miles and Little Snake Reservoir at 4.9 miles.

Response: The figures used in the FEIS are those furnished by the Fish and Wildlife Service.

18. Cumulative Impacts

Comment 1-D-0034: The interrelationship between Cheyenne's proposed interbasin diversion and the Federal policy of encouraging the gasahol, oil shale, and coal gasification industries must be explored.

Response: The cummulative impacts including those of the mining industry forecasted for the diversion area are discussed in detail in Chapter III of FEIS. The data and analysis was furnished by the Army Corps of Engineers.

19. Administrative Changes

Comment 1-D-0050: What happens if elected officials change? Will this negate the Fish and Wildlife recommendations made by the Forest Service as it has in past history.

Response: The mitigation measures and all pertinent documents would be a part of the land occupancy permit. Monitoring would be carried out to ensure permit requirements are met.

Forest Service regulations require that administration of permits be conducted on the frequency indicated in the document pertaining to a particular use.

20. Water Needs

Comment 1-D-0051: The water needs of a community or area are found by multiplying the number of persons in the area by the average per capita consumption of each individual; then adding the consumption of water by various industrial users. These figures that are used in the calculation in the DEIS are entirely unjustified.

Comment 2-D-0051: The population projections for the City of Cheyenne are also subject to doubt. These projections are based largely on the expectations of several large companies in the area.

Response: The population figures used in the DEIS were taken from the 1979 WRRI Cheyenne Stage II Feasibility Study. They had a high and a low range projection, plus a mid-range projection which was a combination of the two weighted toward the high range. The methodology is described on pages B-3 through B-6 of the 1979 document. These pages are also found in Appendix III of this FEIS.

The WRRI (1979) figures used in the DEIS were projected figures based on 1970 census. These figures were gathered by the Department of Administration and Fiscal Control (DAFC) and the Institute for Policy Research (IPR). These organizations are responsible for taking national projections and applying them to the Wyoming data base.

These figures were updated and revised in the RDEIS and the FEIS based on the actual 1980 Census. These figures were considerably less than what had been forecasted by DAFC and IPR for the same period. The methodology for the adjustment of these figures is in Chapter III of RDEIS and the FEIS .

Comment 3-D-0052: You say Alternative C would meet Cheyenne's mid-range water need in the year 2000. As I understand it Cheyenne's projected need is about 22,000 acre-feet and your preferred alternative would provide that much from the west slope streams. But Cheyenne has always obtained 5,000 to 7,000 acre-feet from its Crow Creek drainage and well fields. Alternative C would supply Cheyenne with much more water than the predicted year 2000 need.

Response: According to the best available data at that time the indication was that the amount of water produced by Alternative C would meet Cheyenne's needs to the year 2000 and beyond. This data was taken from page 50 of the WRRI Cheyenne Stage II Feasibility Report (1979).

Additional data were collected during the preparation of the RDEIS. This new data indicated that there were various growth rates that could possibly take place in Cheyenne and the Cheyenne water use area. These new data were analyzed and the periods of supply were mapped out on a graph which is found in the RDEIS, page 20. It indicates that Alternative C could provide the City of Cheyenne with water until the maximum time of 2049 depending on the use rate that occurs in the future. Based on the current use rates of 188 GPCD, the DEIS indicates that Alternative C could last until the year 2005.

The data were reanalyzed and a corrected graph was produced for the FEIS. A display of the results in Chapter II indicates that Alternative C could last the City until past they year 2070 depending on which rate of growth is used.

It is true that any of the development alternatives, if developed in total at this time, would ultimately produce more water than Cheyenne would probably need in the year of 2000.

Comment 4-D-0053: On page 15, the report refers to the "WRRI Feasibility Study; p. 50; November 1979" but this report is not in the reference list. Also this reference is used to project Cheyenne's water need to the year 2000. It would be helpful and more convincing of the validity of this reference if you could briefly summarize the calculation and basis of the projected need. Also, what evidence exists to justify using this projection with confidence for these estimates?

Response: The report referred to is on the reference list in the Appendix I to the RDEIS, page I-7, item number 26. The methodology used for the projections are on pages B-3 to B-6 of Appendix B in the above listed reference. These pages are also in Appendix III of this FEIS.

Comment 5-D-0035: We strongly urge that in the Final Environmental Impact Statement, the Forest Service consider, (1) water recycling; (2) smaller Stage II water developments (providing not more than an additional 5,000 acre-feet/year); (3) inflated population projections; (4) water conservation in conjunction with the above.

Response: According to the State Engineer's Office there are demands on the waste water from Cheyenne downstream in the Middle Crow Creek drainage established over the past 15 years. These demands, under Wyoming water law, must continue to be met. Consideration was given to water recycling in the RDEIS.

Alternative E in the FEIS provides for a staged type of development. Developing Stage II as designed in smaller increments could be economically infeasible due to the high cost of development and materials for the small amount of water received.

The population projections were evaluated in both the RDEIS and the FEIS. Thes new population figures are shown in Chapter III of the RDEIS and FEIS. The background, methodology, and the sources are in Appendix B of the WRRI, Cheyenne Water Project Feasibility Study (1979).

Water conservation was evaluated in Chapter II of the RDEIS and FEIS. It is incorporated in Alternative E. and discussed in Chapters II and IV of the FEIS.

Comment 6-D-0029: Both the population and water consumption projections for the City of Cheyenne are inflated.

Response: The projections have been revised.

Comment 7-D-0040: The alternative proposed by the Forest Service for Stage II of the Little Snake Water Project also known as the Cheyenne Water Project would eliminate much of the temporary water surplus that Casper and other North Platte River communities are planning on using to tide us over until Stage III of project can be built. The need, which the Forest Service has ignored, of Casper and other communities on the North Platte for water is critical.

Response: The purpose of this environmental analysis is to disclose and evaluate the environmental consequences of issuing a permit to the Cheyenne Board of Public Utilities for their development of water. The decision to be made by the Forest Service deals only with whether or not National Forest System lands are available for the development of this proposal. At the same time, there are certain environmental conditions which are present on the Medicine Bow National Forest lands that must be protected. Water is needed to protect riparian habitat and stream channel intergrity.

Whether or not a specific amount of water is available for downstream users depends on the demands of the City of Cheyenne. Any negotiations between Cheyenne and other municipalities is within their own jurisdiction and does not have bearing on the Forest Service decision. If there is water in excess of Cheyenne's needs they are free, as far as the Forest Service is concerned, to do with it what they wish. However, a balanced program of

natural resource management must be continued on National Forest System lands.

21. Indirect Impacts

Comment 1-D-0029: The DEIS fails to adequately identify described "indirect effects" (air pollution, urban sprawl) which the project could well have on Cheyenne and the surrounding urban area. The DEIS also fails to adequately disclose the adverse impacts, particularly streams depletions which will result on the western slope as a result of the loss of water to the Cheyenne area. Finally, the DEIS is deficient in not fully disclosing the adverse environmental effects of the water project on aquatic and terrestrial wildlife on the eastern slope, and it fails to offer satisfactory proposals to mitigate any adverse effects.

Response: There is considerable discussion in this FEIS regarding the possible adverse effects on the socioeconomic setting on the western slope resulting from any water depletions in the area. These discussions can be found in Chapter IV. The associated effects from water depletions such as salinity, damage to threatened or endangered fish species, and additional downstream effects in the Colorado River drainage are also discussed in Chapter IV of the FEIS.

D. Comments and Responses on Issues Specific to the Revised Draft Environmental Impact Statement

1. Fish Habitat - Alternative A

Comment 1-R-0041: In eliminating Alternative A, which would deny the special use permit to divert additional waters from the North Fork to the North Platte, the Forest Service assumes without any examination that the "fisheries population habitat losses associated with inadequate maintenance and flushing flows in Stage I diverted streams would continue to exist..", Revised DEIS p. viii. Clearly, this unexplained and unexamined assumption is nonsense!

Response: This statement is predicated on the assumption that current operations would continue and the Forest Service would not update the present permit to require flows. Alternative A is the No Action alternative.

2. NEPA Requirements

Comment 1-R-0041: Since the Revised DEIS neither publishes the comments on the May, 1980 DEIS nor responds to specific comments, and since the Revised DEIS lists dozens of areas which the Forest Service has failed to make any inquiry, the Forest Service clearly disregards the basic requirements of NEPA regulations in preparing the Revised DEIS.

Response: There is no requirement in NEPA regulations on publishing comments on one DEIS in another. They only need to be published and responded to in the FEIS. According to Section 1952.71,b. Final Environmental Impact Statements, "an agency preparing a final environmental impact statement shall assess and consider comments both individually, collectively and respond in one or more of the means listed below stating its responses in its final statement. Possible responses are to: 1) modify alternatives including proposed action, 2) develop and evaluate alternatives not previously given serious consideration, 3) supplement, improve or modify its analysis, 4) make factual corrections, and 5) explain why comments do not warrant further agency response."

Comment 2-R-0023: The Revised Draft discusses many socioeconomic and institutional issues associated with the project analysis. However, these issues are, for the most part, outside direct authority and responsibility of the Forest Service as a land and resource management agency.

Response: Correct, the Forest Service has made no attempt to arrive a a decision regarding areas which are outside of its direct authority and responsibility. In the Revised Draft Environmental Impact Statement the only requirement is that these effects be disclosed and those agencies which are responsible and have mandates to resolve these problems are thereby alerted to the possibility that these particular problems or situations could occur.

Comment 3-R-0024: One of the purposes of an EIS is to fully disclose impacts of a project and to describe with some position adverse environmental effects which cannot be avoided. In our judgement this is yet to be adequately done.

Response: The FEIS goes into greater detail in many of the areas which have been pointed out in comments to the RDEIS. The section which discusses adverse impacts which cannot be avoided has been expanded to include the

anticipated and cumulative impacts. (See Sections E & F. Chapter IV, FEIS.)

Comment 4-R-0154: Pursuant to Section 102(2)(c) to the National Environmental Policy Act of 1969 and the Council's regulations protection of historic and cultural properties (36 CFR 800), we have determined that your statement is incomplete because it does not demonstrate compliance with Section 106 of the National Historic Preservation Act of 1966.

Response: If Stage II is approved, Cheyenne would contract for a complete archeological and historic investigation of the proposed route of the project. This requirement is found in Chapter II of the FEIS.

3. Flow Requirement - Dixon Gage

Comment 1-R-0041: The statement in the Revised DEIS said a minimum flow of 180 cfs of water is being maintained at the Dixon, Wyoming gage is false.

Response: These estimates, found in Banner (1979) report on the Cheyenne Stage II proposal, were used as a baseline to determine at what point Cheyenne might be required to close their diversion structures and release water to downstream users who have prior rights. This has been corrected in the FEIS; it does not read that this flow is required or maintained

4. Revegetation Requirements

Comment 1-R-0041: The assumption that vegetation disturbed areas would become established within five years is clearly contradicted by the fact that after 17 years vegetation has not become reestablished in the Stage I construction areas.

Response: Revegetation is considered sucessful when at least 50% of the ground cover is present. There is in excess of 51% of ground cover established on the Stage I construction area. In the eyes of many, it may not appear to be revegetated, but according to the standard set for the species present, it is. The only vegetation that has not reestablished is the tree cover which would require several years. The revegetation requirements do not require trees to return to their normal height within five years.

5. Payback System

Comment 1-R-0164: The revised statement does not discuss the important interagency coordination or analyze Seminoe Reservoir role in the payback scheme. We feel the

document is dificient in this area and could result in additional NEPA compliance by the Bureau of Reclamation if the water exchange results in the modified reservoir operation.

Response: The role of the Seminoe Reservoir in the payback scheme is being investigated by the State Water Engineer and the Field Water Engineers for that area. The final determination has not been made. The payback scheme shown in Appendix II, Modified Release Schedule V, page II-150, of the RDEIS is the Forest Service recommendation.

Comment 2-R-0081: The RDEIS should clearly state that an advance payback plan for Hog Park releases into the Encampment and North Platte River is a preference, but as an alternative, should advance payback fail to become a reality, a pipeline from Hog Park Dam to the Encampment River is an acceptable option.

Response: There is no indication that a pipeline from Hog Park to the Encampment River is an acceptable option. The payback system involves both Hog Park Creek and the Encampment River. It is true that a pipeline system would alleviate the problem on Hog Park Creek, but it would do nothing towards alleviating the problem on the Encampment River.

6. Cumulative Effects

Comment 1-R-0164: We believe the final documents should acknowledge the pending water rights ajudication for Dinosaur National Monument.

Response: The water right case for Dinosaur National Monument is discussed in the "Draft Wild and Scenic River Study - Yampa and Green Rivers," (NPS, 1979) and incorporated into the FEIS by reference in Appendix I of the RDEIS.

Comment 2-R-0043: The alternatives, general research and scope of the DEIS are all outdated.

Response: The data used in the FEIS has been updated to a 1980 base. Important references used in the earlier DEIS have also been updated and noted in Appendix I of the RDEIS.

7. Wild and Scenic Rivers

Comment 1-R-0164: The draft statement fails to mention the existence of potential impacts on the Encampment Wild and Scenic River.

Response: Preservation of the character of this river until a decision on designation is reached, is one major reason for the development of the payback scheme.

8. Mineral Claims

Comment 1-R-0164: The draft statement does not mention the potential impacts on mineral resources, specifically the amount of acreage removed from mineral exploration, the effects of the proposal on prior existing rights, unpatented claims, mineral applications, etc.

Response: Currently Cheyenne is in the process of examining the development areas of Lake Creek and Rob Roy to identify the claimants and resolve the claims that would be involved with the construction of Stage II. An examination by the Bureau of Land Management shows that there are no claims that would be impacted in the Sierra Madre Mountain area.

9. Indirect Impacts

Comment 1-R-0024: All the indirect effects of Stage II on the City of Cheyenne are mentioned in passing on page 137. There is no thorough examination of these effects. An increased population in Cheyenne would result in more urban sprawl, more air pollution, and more energy consumption due to auto dependency. Until the true extent of these impacts in Cheyenne are identified the gravity of the environmental impacts of Stage II cannot be fairly assessed.

Response: The sociological impacts are thoroughly examined in the FEIS. They have been assessed to the extent that the cooperating agencies felt necessary.

10. Water Consumption Inflated

Comment 1-R-0024: The DEIS also uses inflated per capita water consumption figures. Projections are based on annually escalated water use but no justification is given for the assumption that use will increase.

Response: Agree. The use figures for Cheyenne have been recalculated and reevaluated in the FEIS.

11. Soil Survey Inadequate

Comment 1-R-0095: A Third Order Soil Survey is totally inadequate for a project of this magnitude.

Response: A Third Order Soil Survey is a general survey of the entire corridor which could be impacted by the proposal. An Order One Survey would be made within the

immediate areas of disturbance, should the project become a reality.

12. Chart II-1

Comment 1-R-0095: The careful reader of the DEIS should note the obvious errors in Chart II-1 page 67 the pipeline miles for Alternative A should read 0; Alternative B - 98.8; Alternative C - 94.1; and Alternative D - 79.37.

Response: The corrected figures are in the FEIS.

13. Three Forks Reservoir

Comment 1-R-0128: I would like to know how you propose to store a significant amount of the 100,000 acre-feet of unappropriated water you mentioned in a lake located on our ranch covering approximately 2,000 acres of our land?

Response: The Three Forks Reservoir was presented only as a possible option of reservoir sites for Alternative D. The location of this reservoir would, of course, depend on the willingness of the land owner to have a structure such as this on their property.

14. Pole Mountain Pipeline

Comment 1-R-0081: The Forest Service should not be permitted to require that a pipeline be installed between Pole Mountain and Granite.

Response: The need to maintain the stream channel intergrity on Pole Mountain indicates that a pipeline would be a reasonable way to do this.

Comment 2-R-0104: The concerns include minimum stream requirements at Douglas Creek, additional water rights issues in the Little Snake River system, additional costs of pipeline between Pole Mountain and Granite Reservoir, and additional costs to the City of Cheyenne for the Federal agencies work in preparing the DEIS.

Response: The need for the pipeline to be installed between Pole Mountain and Granite Reservoir is discussed in the Fish and Wildlife Coordination Act Report, Appendix II, Section 10, Revised Draft Appendix. Water rights issues and the need for stream flows are discussed in Chapter IV of the FEIS.

The Forest Service has not charged Cheyenne for preparing any of the EIS's concerned with this proposal.

Comment 4-R-0142: The citizens of Cheyenne should not be required to pay for pipelines from Pole Mountain to Granite Reservoir because the natural drainage channels would accomodate any increased water flow.

Response: It is the opinion of the hydrologic and fisheries experts of the Forest Service, United States Fish and Wildlife Service, and Wyoming Game and Fish Department that the streams on Pole Mountain now supporting Stage I flows cannot further be augumented by additional flows without making serious changes in the channel integrity and in the streamside ecosystems.

15. Wyoming-Colorado Coordination

Comment 1-R-044: There has been no serious study of inbasin needs of the ranches and small towns of the Little Snake River valley. There has been no coordination between the States of Colorado and Wyoming, or other Colorado River Compact states.

Response: There has been coordination between the Wyoming State Engineer and the water authorities of Colorado regarding the use of Colorado River Compact water. Also the Salinity Control Forum documents and the Colorado River Compact have been researched regarding the development of upper Colorado River water.

Impacts on the downstream uses are discussed further in the FEIS.

16. Economic Value of Wildlife

Comment 1-R-0045: The statement does not really discuss the economic value; yes economic value; of maintaining fish and wildlife resources which will be damaged by the Cheyenne proposal.

Response: According to the analysis by the Fish and Wildlife Service, the Forest Service, and the Wyoming Game and Fish Department the mitigating measures applied to Cheyenne Stage II would offset any wildlife losses which may occur as a result of Stage II development, should it become a reality.

Comment 2-R-0089: The report refers to the number of fish habitat units which would be lost in the various miles of streams which will either be temporarily or permanently changed. It does not state, at least that I have found, additional quantity of fish which the increased size of reservoirs could hold. This should increase the fish habitat by a very much greater majority than would be lost by construction. On this point I feel the impact statement is misleading.

Response: It is true that large lakes could hold more fish. However, the reproductive capacity of the lakes analyzed is of near zero value in maintaining a stable fish population. Although these lakes could hold more fish, impacts could actually increase because the Wyoming Game and Fish Department would have to stock more fish per lake than they do now to provide the same quality fishing experience.

17. Alternative D - Yield

Comment 1-R-0081: The yield of Alternative D, as discussed should be reduced by 2,100 acre-feet per year. Thus the term of supply indicated as the year 2066 should be reduced accordingly.

Response: The Forest Service and Banner Engineering reevaluated the amount of water which could be produced by Alternative D. The water has been reduced from 20,100 acre-feet to 18,000 acre-feet in the FEIS and the term of supply has been adjusted accordingly.

18. Stream Length

Comment 1-R-0081: The board disagrees with the length of stream loss due to the enlargement of Hog Park and Rob Roy Reservoir.

Response: The stream length that the Forest Service is using was provided by the Fish and Wildlife Service.

19. Water Use Figures

Comment 1-R-0081: We disagree with the figure of 124 GPCD (1980 Uses). Page II-70 shows an estimated 1980 residential demand of 3,486,300,000 gallons at an estimated population of 59,860.

Response: The Forest Service, Banner Engineering, and Cheyenne revised the gallon per capita projection that is being used for domestic, industrial and commercial uses. These readjusted figures are reflected in Chapters II and IV of the FEIS.

20. Migitation

Comment 1-R-0103: Two of the Forest Service requirements directly affect Ferguson Ranch land. The augumentation of Bamford Creek east of the Forest will cause numerous problems on Ferguson lands.

Response: The Forest Service, Fish and Wildlife Service, and the Wyoming Game and Fish Department are currently in negoiation with the property owners on the Ferguson

Ranches in an atttempt to arrive at an equitable measure which would mitigate the losses on National Forest System land without disturbing operations on private lands.

Comment 2-R-0145: There are no assurances that the desired mitigating measures suggested by the Forest Service will be carried out.

Response: Migitation measures would be included .in the Land Occupancy Permit. It would be required that these measures be implemented and included n the monitoring program which would follow the construction of the proposal, should it become a reality.

21. Forest Service Delays

Comment 1-R-0119: The project has been studies literally to death. I have been utterly amazed at the length of time taken in the studies in the efforts of the Forest Service to placate the few extremists in the environmental movement.

Response: The time taken in this proposal has been only that needed to comply with the National Environmental Policy Act. It is true that there have been delays during the project but there was additional information received from the Cheyenne Board of Public Utilities and a need to further explore conservation alternatives which caused a delay.

II. COOPERATING AGENCY COMMENTS AND FOREST SERVICE RESPONSES

Each group of comments and responses refers to correspondence received from the agency identified in the heading. The letters are reproduced, and the comments in each are bracketed and numbered. Copies of the correspondence follow each comment and response section.

A. Wyoming Game and Fish Department Letter of July 10, 1981

(See p. V-48)

Comment 1.

Response - This material has been incorporated into the discussion of Alternative B - Chapter IV - FEIS.

Comment 2.

Response - This table has been incorporated in Appendix IV of the FEIS.

Comment 3.

Response - This material has been incorporated into the discussion of Alternative C - Chapter IV - FEIS.

Comment 4.

Response - This material has been incorporated into the discussion of Alternative D - Chapter IV - FEIS.

Comment 5.

Response - This material is included as part of the mitigation requirements - Chapter II - FEIS.

Comment 6.

Response - This material is included as part of the mitigation requirements - Chapter II - FEIS.

Comment 7.

Response - This material is included as part of the mitigation requirements - Chapter II - FEIS.

Comment 8.

Response - This material is included as part of the mitigation requirements - Chapter II - FEIS.

Comment 9.

Response - Currently roads are recommended for closure during construction. Road closures following construction would be

evaluated in the Forest and Transportation Plans on the Hayden and Laramie Ranger District.

Comment 10.

Response - Land acquisition as a mitigation measure has been disclosed in Appendix IV of the RDEIS.

Comment 11.

Response - This is the intent of this mitigation measure as disclosed in Chapter II of the RDEIS and FEIS.

Comment 12.

Response - This is the intent of all mitigation measures plus requirements which would be contained in the occupancy document.

Comment 13.

Response - This would be a condition of the requirements of the attached to the deed discussed on page 65 of the RDEIS. Without public access it would be unacceptable for mitigation.

Comment 14.

Response - This is correct. The reason for monitoring the operation is to ensure the conditions in the occupancy document would be met.

Comment 15.

Response - The data source is the Wyoming Population and Employment Forecast Report: Department of Administration and Fiscal Control; 1980, page 24.

Comment 16.

Response - Data gathered for water in the Little Snake River area by the Forest Service also indicates high lead concentration. Lead concentration is part of the "heavy metals" referred to under water quality in Chapter III - FEIS.

Comment 17.

Response - Rainbow trout has been included in the list of species found in the Encampment River - Chapter III - FEIS.

Comment 18.

Response - Flows would be increased in Douglas Creek during low flow periods to 5.5 cfs not reduced.

Comment 19.

Response - It has been estimated that during high runoff there would be a maximum of 3%-5% reduction in inflow from Douglas Creek.

Comment 20.

Response - This information is in the Public Information File at the Medicine Bow National Forest office.

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Game and Fish Department

CHEYENNE, WYOMING 82002

EARL M. THOMAS
DIRECTOR

July 10, 1981

EIS 473/L8
Cheyenne Stage II Water
Project, Revised DES.

Mr. Don M. Bolinger
Cheyenne Stage II Project Coodinator
Medicine Bow National Foreet
605 Skyline Drive
Laramie, Wyoming 82070

Dear Mr. Bolinger:

We have reviewed the revised draft EIS including the subsequent Appendix relating to the Cheyenne Stage II Water Diversion proposal, and offer the following comments and suggestions for your consideration in developing the Final EIS for this project.

Alternatives and their effects, ae we preceive them, are as follows:

Alternative A. No Effect on wildlife.

1. Alternative B, Page 126. The construction of 22.7 miles of new road from Rose Creek to the Roaring Fork of the Little Snake River will result in a loss of 45.4 acres of big game habitat. Elk and deer will be displaced from a greater area during thie construction. If the road remaine open to public accees, elk will continue to avoid areas within .25 miles of moving vehicles (Ward, 1980). Adverse impacts have been reported to a distance of .9 miles from open roade by Lyon (1979). Penz and Overly (1977) reported big game displacement up to .5 miles. Elk in the Gros Ventre range were displaced a minimum of .5 milee from open roada.

Based upon the above, at least an additional 7,264 acres of habitat will be severely impacted and its use by elk significantly reduced or lost if the propoeed roads are constructed and remain open to public access. Depending on topography and cover as many ae 26,150 acres may be adversely impacted. Table 1 shows lost or impacted acreages for this and other alternatives based on the values quoted from the above studies

2.

TABLE 1

Elk Habitat Loss from the Proposed Road Construction and Related Human Activity Along Open Roadways

Alternative	Miles of New Road	Acres of Elk Habitat lost to road construction due to animal displacement from human activity*		
		.25 mile	.5 mile	.9 mile
A	0	0	0	0
B	22.7	7,264	14,528	26,150
C	15.8	5,056	10,112	18,202
D	8.8	2,816	5,632	10,138

*From data presented by Ward (1980); Perry and Overly (1977); and Lyon (1979).

This is the preferred alternative of the City of Cheyenne.

3. Alternative C, Page 134. Using the same criteria noted in Alternative B, a total of 5,056 acres of elk habitat will be lost if proposed roads are constructed and remain open to public use, with adverse impacts anticipated or 18,202 acres (Table 1). This alternative is favored by the U. S. Forest Service.

Of the action alternatives considered, Alternative C would result in the least adverse impacts to fisheries if Stage I flow inadequacies are corrected and an adequate payback regime is adopted. If Stage I flows and payback issues are not resolved, Alternative A--no action or one of the discarded alternatives (conservation, purchaee of agricultural water, etc.) would be best for fish and wildlife.

4. Alternative D, Page 142. Using the same criteria developed in Alternative B above, 2,816 acrea of elk habitat would be lost if roads are constructed and remain open. Adverse impacts to big game habitat are expected to effect 10,138 acree of habitat under this alternative (Table 1).

Thie alternative has the least amount of measurable impact on elk habitat.

Mitigation, Pagee 63 and 66. Draft EIS Rev: Page II-113 Appendix P.

Proposed mitigation for habitat losses to terrestrial wildlife is:

5. A. Fence 100 acres of riparian habitat along South Fork of Crow Creek;

6. B. Relinquish 340 acres of land owned by the Water Board of the City of Cheyenne along the shoreline of Lake Owen, to be managed by the Forest Service;

7. C. Seed 400 acres of clearcut blocks to grass in the Hayden Ranger District. This would provide additional grazing for approximately 25 years;

8. D. Treat 160 acres of aspen on the Hayden Ranger District. Benefits from this program may last from 80-120 years;

E. Acquire 900 acres of land outside the National Forest by the Wyoming Game and Fish Department to be managed for wildlife.

Appendix, Page II-113

Comment:

a. The proposed fencing is primarily to protect the anticipated new stream channel formed by the augmental flows in this tributary. The duration of this fence (benefits) is stated as being..."about 5 years, or until a new streambank is established and stabilized" (Appendix: Page IV-99). Page II-112 of the Appendix states..."The area is remote from existing water. Therefore cattle are not able to fully utilize the range." On June 18, 1981, District V personnel walked this drainage from USFS road 700 downstream to the boundary. The area consists of a large, wet meadow with standing water 3" to 18" deep. Two springs flow into the drainage from the north. Cattle droppings indicated good cattle use in the past. The vegetation along the bottom consists of rushes and sedges. If the stream is channeled by the augmented flows, fencing is necessary to protect the new banks. This should be considered a necessary practice to protect the land from the change in use. The anticipated change from a wet meadow to rangeland with a stable stream channel is of questionable value as mitigation for terrestrial wildlife losses.

b. This item is an acceptable form of mitigation for terrestrial wildlife.

c. Seeding of clearcuts with non-sod forming grasses should not be considered long-term mitigation for terrestrial wildlife losses.

d. This treatment was originally proposed for an additional 1,000 acres, and to benefit both livestock and wildlife. This recommendation should also be considered a normal management practice rather than as mitigation of lost wildlife values.

e. The acquisition of 900 acres of land outside of Forest Service boundaries is certainly acceptable migigation, however in light of the scope of habitat loss, and comments regarding A, C and D, the figure appears low.

In 1980, 4,708 elk hunters spent 15,425 days pursuing elk in the Sierra Madre Range, with two-thirds of the effort on the west slope. Many of these hunters are from Cheyenne. It would be unfortunate if elk hunting quantity and quality declined as a result of this project when simple road closures could prevent this. In every stage of development of this EIS we have stressed the importance of having roads constructed in conjunction with the project so that they may be closed, totally or in part, to minimize disturbance to big game--principally elk. The evidence documented in the studies cited above supports the need for wildlife values to be a primary consideration both when these roads are constructed, and after construction is completed. The road from the Rob Roy diversion to Lake Owen established a precedent for this closure.

Conclusions:

From the above it is concluded that:

1. The construction of roads in conjunction with Alternatives B, C, or D will result in elk habitat loss and displacement of elk from at least 2,816 acres under Alternative D at the .25 mile disturbance factor, and a maximum of 26,150 acres of habitat under Alternative B using the .9 mile factor.

2. Mitigation items A, C and D are good land management practices that are of limited value to livestock and wildlife, or relatively short duration, and of questionable value for mitigation of wildlife habitat losses.

Recommendations:

We recommend that:

9. 1. All roads constructed in conjunction with the Stage II project be closed after completion of the project except for periodic maintenance to structures and facilities. These roads may be open when, in the consideration of the Wyoming Game and Fish Department and the U. S. Forest Service the opening of such roads or portions thereof will be a benefit, or at least not a detriment to wildlife.

10. 2. If roads are to remain open, the proposed 900 acres of land acquisition should be increased to the minimum acreage of wildlife habitat impacted by the accepted alternative, as noted in Table 1. The 340

acres relinquished around Rob Roy Reservoir would apply toward the total.

Specific comments relating to fisheries resources are in order of pagination of the EIS and the Appendix.

11. Page 63. The flows in South Fork of Middle Crow Creek must be on a continuous basis in order to develop a fisheries.

12. Pages 63-66. Requirements for all action alternatives should also include a requirement for best management practices for pipeline and diversion construction.

Page 64. Paragraph 2 mentions that a suitable water release system must be devised so that Hog Park Creek and Encampment River channels are protected. We support this condition. If this condition were not met, a reassessment of fisheries impacts would be necessary.

There are still some questions regarding the unadjustable bypass structure. The diagram presented in the 404 permit application for this project shows a slide gate on the maintenance flow bypass pipe. This will require precautions to insure proper adjustment, calibration and freedom from tampering. Calibration immediately at the end of the bypass line would be necessary. Calibration some distance downstream could be biased through accretion and timing--whether the stream was influent or effluent to its banks at the date of calibration. Once adjusted, the gate should be permanently set by welding or with concrete. Measures should be taken to prevent debris from causing flows to partially overshoot the maintenance flow chamber of the structure and shorting the flow requirements.

13. Page 65. Guaranteed public hunting and fishing access to the lands Cheyenne has around Rob Roy Reservoir should be spelled out.

14. Page 66, first paragraph. Provisions to protect fish populations should be employed during construction. Habitat destruction should be avoided, not demonstrated.

15. Page 94, Table III-3. What is the source of data for the projections?

16. Page 97, Water Quality. Game and Fish Department records show lead concentrations are high also.

Page 101. Gyrodactylus and high lead concentrations may be interrelated.

17. Page 103, second paragraph. Rainbow trout are found in good numbers in the lower portion of the Encampment River.

Page 105. Rob Roy Reservoir fishery is jeopardized by no minimum pool and a large non-game fish (sucker) population. A fish trap could be incorporated into the bridge design that crosses Douglas Creek above the reservoir to aid in controlling the sucker population.

18. Page 106. Reduced flows in Douglas Creek may have a negative influence on spawning migrations out of the Platte River. Our personnel have observed that water levels are sometimes so low as to hamper fish passage. Other undiverted streams of similar character in this general area do not have this problem.

Page 109 d. Because of a more rapid turnover rate of water in Lake Owen this lake may become less productive as a fishery.

19. Page 109 f. The section of river from Douglas Creek to the Encampment River is used for floating; however, this stretch of the Platte River is not white water or filled with rapids. All boating use would be shortened.

Appendix II - 149. We support the Forest Service opinion that a daily payback system is unsuitable; however, the release schedules proposed on page II - 149 for Hog Park Reservoir offer little improvement. Specific objections are to the August and September flows which are less than flows for those months under the existing system (Stage I). Considerable confusion has resulted because the January, 1981, release schedule proposal is quite different than previously proposed schedules. We support the Forest Service proposal on page II-150 for releases from Hog Park Reservoir.

20. Pages II - 148-150 should also display the flow regimes for the Encampment River for each release proposal.

Please contact this office or our District Office in Laramie if we may be of further help on this project.

Sincerely,

W. Donald Dexter

W. DONALD DEXTER,
ASSISTANT DIRECTOR, OPERATIONS
WYOMING GAME AND FISH DEPARTMENT

WDD:HBM:mlr

cc: State Planning Coordinator
cc: Game Division
cc: Fish Division
cc: U.S. Dept. Army, Omaha Dist. Corps of Engs.

B. Environmental Protection Agency Letter of July 18, 1980
(See p. V-52)
Comment 1.

Response - We agree, and have evaluated water conservation. Alternative E was developed for the FEIS. Water Conservation is included as a portion of this combined alternative along with groundwater development and the purchase of agricultural water rights. The discussion of Alternative E is in Chapters II and IV of the FEIS.

Comment 2.

Response - The data was reevaluated in the RDEIS and in the FEIS. Graphic representation is on page 20 of the RDEIS and in Chapter II of FEIS. There is additional information incorporated in Chapter III of the RDEIS and the FEIS.

Comment 3.

Response - All items listed have been discussed in Chapters II, III and IV of the FEIS. The only exception is Item 5. There was not sufficient data submitted to respond to this item.

United States
Environmental Protection
Agency

Region 8
Suite 103
1860 Lincoln St.
Denver, CO 30295

Colorado, Montana,
North Dakota,
South Dakota,
Utah, Wyoming

EPA

JUL 18 1980

RECEIVED
JUL 22 '80
LM&PP

REF: 8W-EE

Mr. Craig W. Rupp
Regional Forester
Rocky Mountain Region
11177 W. 8th Avenue, Box 25127
Lakewood, Colorado 80225

Dear Mr. Rupp: Craig

We have reviewed the draft environmental impact statement for Cheyenne's proposed Stage II water diversion proposal. For the most part we believe the Forest Service has done a good job of trying to quantify the effects of constructing the alternatives that are addressed in the EIS. We also think it is commendable that you are supporting a proposed action that would maintain higher stream flows compared to Cheyenne's proposal. However, we view several omissions, particularly an analysis of water conservation and recycling, as serious deficiencies in the impact statement.

1. The President's water policy initiatives recognized that more efficient use of water is generally less costly economically and environmentally, and they made it clear that water conservation is a national priority that should be integrated into the programs and policies of all federal agencies. In keeping with the water policy initiatives, we think every federal agency has a special responsibility to not only evaluate the potential of water conservation and recycling in its water resource development impact statements but to also appropriately size its projects or condition its permits to reflect a commitment to conserving existing water supplies.

2. Before alternatives can be evaluated, the need for additional water supplies should be firmly established. The EIS does not do this and the Banner Associates Report (Banner Supplemental Information; 1979) does not do this. The Water Resources Research Institute study (WRRI feasibility study; November 1979) does a more thorough analysis of projecting needs but the EIS fails to integrate the WRRI information into its analysis. For example, the EIS states the WRRI study projects a year 2000 need of 22,500 acre-feet based on mid-range population estimates. Given the existing average annual water supply of 14,000 acre-feet, the additional water needs for the year 2000 would only be 8500 acre-feet while the Forest Service's preferred alternative would provide 21,500 acre-feet. When a reasonable determination of water needs has been made, the alternatives analyzed should reflect actual needs (e.g., if 10,000 additional acre-feet of water would meet the reasonable needs of Cheyenne, the alternatives analyzed should not be for 27,000 acre-feet). The EIS is very vague about relating actual needs to the project size and the evaluation of alternatives.

-2-

3. We suggest that you reissue the draft EIS and include the following changes:

1. There should be a sound evaluation of actual water needs.

2. Water conservation and recycling should be thoroughly evaluated as complete or partial alternatives to development of new supplies.

3. The alternatives analysis should reflect actual projected needs and water conservation and recycling.

4. The environmental and economic impacts of downstream salinity impacts should be discussed along with mitigation measures (e.g., reduced diversions).

5. The secondary impacts resulting from an oversupply of water as proposed by Cheyenne should be analyzed.

6. A conformity determination in accordance with Section 176(c) of the Clean Air Act should be included.

While we recognize that you have made a good-faith effort to analyze alternatives and mitigate environmental degradation, we believe the draft EIS falls far short of its intended purpose. We have assigned it a rating of category 3 (inadequate). It might be helpful if members of our regional staffs met to discuss our comments. My staff contact person for this project is Gary Johnson (837-4831).

Sincerely yours,

Roger

Roger L. Williams
Regional Administrator

C. Environmental Protection Agency Letter of July 9, 1981
(See p. V-54)
Comment 1.

Response - This has been discussed in Chapter II and IV of the FEIS in more detail. A planning period was used, and Alternative E allows for a system of staging equated with growth needs.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
1860 LINCOLN STREET
DENVER, COLORADO 80295

JUL 9 1981

Ref: 8W-EE

Mr. Craig W. Rupp
Regional Forester
Rocky Mountain Region
11177 W. 8th Avenue
P.O. Box 25127
Lakewood, Colorado 80225

Dear Mr. Rupp:

We have reviewed the revised draft environmental impact statement for Cheyenne's proposed Stage II water diversion proposal. We are pleased that you decided to prepare a revised draft EIS to better address some important issues, especially water conservation. Your analysis clearly shows that conservation represents a significant source of water for meeting Cheyenne's future needs.

There are still weak areas of the EIS that detract from its usefulness. One of these is the portrayal of water needs for Cheyenne. The EIS does show several future use projections based on different consumption rates, but it assumes a fixed composite population growth rate that could be off by a significant amount. This tends to paint an unrealistically rigid picture of future water needs that could be in considerable error, and which could spawn an oversized water project that would be both a burden to the taxpayer and unnecessarily environmentally destructive. We suggest that, where appropriate, you show projected water needs using a reasonable range of population projections to reflect the uncertainty in forecasting future needs.

1. We recommend a different presentation of the relationship between development and sizing of alternatives and the projected future needs of the area. This presentation would establish a reasonable planning period, determine the range of projected needs during that period, and discuss development alternatives (including sizes) corresponding to that range of needs. The user of the EIS would be better enabled to see the balance between addressing projected needs and minimizing both capital costs and environmental degradation.

-2-

As we mentioned in our comment letter on the original draft EIS, we think it is commendable that you are supporting a proposed action that would maintain higher stream flows compared to Cheyenne's proposal. However, your preferred alternative still appears to be larger in size than is necessary to provide for Cheyenne's needs for a reasonable planning period. In the public's interest, we think the final impact statement should incorporate the suggestions we've put forth in this letter and on previous occasions. We also urge you to consider a condition on your permits to Cheyenne that requires a reasonable and effective water conservation program.

Thank you for giving us the opportunity to review and comment on this revised draft impact statement. We have designated these comments as ER-2. This means we have some environmental reservations concerning the proposed action and would like to have some additional information on water conservation included in the final EIS. As always, we are available to discuss our comments with you.

Sincerely yours,

Gene A. Lucero, Deputy

acting for Roger L. Williams
Regional Administrator

D. United States Fish and Wildlife Service Letter of July 17, 1980 (See p. V-57)

Comment 1.

Response - This recommendation has been included in the RDEIS and FEIS - Chapter II.

Comment 2.

Response - The augmentation was changed to South Fork of Middle Crow Creek and is included in the RDEIS as a mitigating measure for Alternatives B, C, and D. This was changed since South Crow Creek is off the National Forest and there would be no public benefit. The wording of the augmentation process is on page 63 of the RDEIS. Both discussions are in accordance with the Fish and Wildlife Coordination Report, in Appendix II, Section 10, of the RDEIS.

Comment 3.

Response - The final decision of Cheyenne and the engineering company was that the Lake Creek pipeline system would be constructed under Alternative C.

Comment 4.

Response - The Forest Service would prefer not to have the pipeline constructed in this area. If the amount released from the payback system is not satisfactory for the Encampment River, building the pipeline would solve no problem. The best resolution is to design a payback system where the needs of both streams can be met. A discussion of the payback system recommended by the Forest Service is in Appendix II, p. II-150, of the RDEIS.

Comment 5.

Response - The discussion of impacts on terrestrial wildlife was expanded to include these concerns in the RDEIS and FEIS - Chapter III and IV.

Comment 6.

Response - These data were incorporated into the wildlife discussion in Chapters II, III and IV of the RDEIS and FEIS. They can also be found as reference material in Appendix IV to the RDEIS.

Comment 7.

Response - This concern has been discussed in Chapters III and IV of the FEIS.

Comment 8.

Response - These items have been further addressed in the RDEIS and FEIS and are included as mitigating measures for all development alternatives. There is agreement between the Forest Service, Fish and Wildlife Service, and the Wyoming Game and Fish Department on these measures.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Billings Area Office
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101

JUL 17 '80

IN REPLY REFER TO:

ES

July 14, 1980

Mr. Craig W. Rupp
Regional Forester
Rocky Mountain Region
11177 West 8th Avenue
P.O. Box 25127
Lakewood, CO 80225

Dear Mr. Rupp:

We have reviewed the draft environmental impact statement (DEIS) entitled, "Cheyenne Stage II Water Diversion Proposal," prepared by the Medicine Bow National Forest. The following constitutes the comments of the U.S. Fish and Wildlife Service (FWS).

We were generally pleased with the high quality of your DEIS, especially the treatment given to fish and wildlife resources associated with aquatic habitats.

As you know, our Fish and Wildlife Coordination Act (FWCA) Report (Draft of March, 1980) outlined the expected impacts associated with this water development project and recommended appropriate mitigating measures. The comments herein discuss specific areas of concern identified by us in your draft EIS and generally point out some potential conflicts between your "preferred alternative" and the Fish and Wildlife Coordination Act.

1. Item (a) on pages 4 and 37 states, "All Stage I and Stage II diverted streams would have a maintenance flow to insure that 100 percent of the fishery and riparian habitat is protected." In order to avoid confusion with terminology in the FWCA Report, we recommend that "maintenance flow" be defined or replaced with "maintenance and flushing flows."

2. Item (h) on pages 4 and 37 calls for flow augmentation to the South Branch of Middle Crow Creek as a mitigating measure for fishery losses. We endorse that recommendation. However, both the FWS's Coordination Act Report and the Wyoming Game and Fish Department also recommend that flows also be augmented in South Crow Creek. The Wyoming report, "Quantification of Trout Habitat that Could be Impacted by Stage II of the Proposed Cheyenne Water Development Project" by Don O. Miller, March 1980. indicates that a net loss of fish habitat units would occur under the Forest Service preferred alternative. We again strongly urge that additional water be augmented to South Crow Creek to offset fishery losses. If necessary, these augmented flows could be restricted to low flow periods and to quantities which would not exceed the capacity of the City's existing collection system.

There is some confusion in the discussion of the Forest Service's preferred alternative (Alternative C) on page 54. It is stated that, "The existing Douglas Creek facilities would produce all the water necessary to equal the water paid back by the Little Snake collection system." If this is the case, then there would be no necessity to construct the Stage II Lake Creek system. The confusion arises from the following statement about the Lake Creek system, "It is doubtful that this system

3. would be constructed under this alternative." It is recommended that this last sentence be changed to reflect the fact that the Lake Creek system would not be constructed under Alternative C.

4. In Appendix VIII (page VIII-4) it is stated that the Wyoming Legislature has authorized the construction of the Hog Park to Encampment River pipeline. This action would mitigate the adverse impacts expected to occur to Hog Park Creek as described in our draft FWCA Report and on page VII-20 of your DEIS. Thus, we recommend that your preferred Alternative C be amended to include the Hog Park to Encampment River pipeline.

5. On page 19 of the DEIS, the only management concern identified with regard to the potential effect of the project on terrestrial wildlife is the possibility that it might result in a change in hunting pressures. We feel that there are other management concerns which should also be addressed. Among these are the potential impact of the project on important wildlife habitat, such as winter range and riparian areas and the effect of the proposed project on the distribution and abundance of wildlife in the project area. The identification of a single "management concern" has resulted, we feel, in a narrow approach being taken in assessing the impacts of the project on wildlife. Furthermore, the evaluation criteria for terrestrial wildlife outlined on page 33 of the statement are too restrictive to result in a thorough evaluation of the various alternatives. This is particularly true in light of the significance given to the various criteria as described on page 116 of the DEIS. For example, the first criterion, "Game Species Existing," measures only whether or not the abundance of any game species would be reduced to zero by the project. We feel this view is too narrow, both because it deals only with potential effects on game species, and because effects short of extirpation are not considered. The criterion should be expanded to include both game and non-game species and to reflect the effects on wildlife other than outright extirpation.

JUL 16 1980

6. The second criterion, "Habitat Lost," should also be modified, we feel, to include some measure of the effect of habitat loss on the wildlife community in the project area. Listing species which would be affected by habitat loss does not provide a complete picture of the effect of the project on wildlife. Factors such as the impact on community diversity and productivity should also be addressed. We strongly disagree with the assessment that the loss of up to 1,907 acres of habitat will not affect any species utilizing it. As described in the draft FWCA Report, we feel many species will be adversely affected by the loss of habitat, and particularly, by the loss of up to 514 acres of riparian habitat. We also feel that habitat which would be lost to construction of permanent roads should be included under this criterion. These areas are not now considered in the statement and, under certain alternatives, would involve important wildlife habitat such as elk winter range under Alternative F.

7. The final two criteria, "Consumptive and Nonconsumptive Use," are both related to the amount of habitat that would be opened to vehicular access that is not now roaded. We feel these criteria should be combined and redefined to address all potential impacts associated with providing access to presently unroaded areas. Impacts associated with increased consumptive and nonconsumptive use could still be addressed along with other impacts resulting from increased human disturbance which are not presently treated. It is our opinion that the effects of providing access to presently inaccessible areas will have a negative impact on wildlife rather than the beneficial one projected in the DEIS. According to the Wyoming Game and Fish Department, access in the area for hunting and fishing is adequate. Providing increased access would, they have stated, be detrimental to wildlife, and in fact, may be one of the greatest problems for wildlife with regard to the proposed project.

Because of the various problems we have identified with the evaluation criteria, we feel the impacts of the project on wildlife should be reassessed. The final FWCA Report, when issued, should provide a major source of information for your use in the reassessment. We believe our final report will be issued in mid-August 1980.

8. Item (C) on page 5 and Item (D) on page 106 both state that wildlife habitat losses would not be mitigated if any of the proposed alternatives, along with the proposed mitigation plan, were implemented. We concur with this assessment. In light of the FWCA and its stated purpose (i.e., to ensure that wildlife resources receive equal consideration with other water development project features) we believe the proposal as presented is inadequate. Of particular concern is the apparent rejection, of major portions of the FWCA Report terrestrial mitigation proposal. This proposal would, to some extent, mitigate the adverse impacts of the project on wildlife. The proposal included a recommendation on road closures to protect wildlife, a recommendation to establish an aspen management area, and a land purchase proposal. Only the land purchase recommendation was referred to in the DEIS, and it was rejected without explanation. We do not feel that the rejection of the FWCA Report proposal is justified.

Due to the nature of the concerns expressed herein, we request a meeting with the Forest Service to discuss the DEIS. We would also like to explore alternative measures to mitigate losses of terrestrial wildlife habitat.

We appreciate the opportunity to comment on your DEIS.

Sincerely,

Robert M. Ballou

Robert M. Ballou
Acting Area Manager

cc: Director, Wyoming Game and Fish Department, Cheyenne, WY
Wyoming Game and Fish Department, Laramie, WY
District Manager, BLM, Rawlins, WY
Robert Roumpf, COE, Omaha, NE
Regional Director, USFWS, Denver, CO (ENV)
FWS/OEC, Washington D.C. (EC# 80/25)

E. United States Fish and Wildlife Service letter of June 16, 1981 (See p. V-60)

Comment 1.

Response - The USFWS opinion was issued on June 1, 1981 and was referred to in Chapter IV of the FEIS. The opinion can also be found in its entirety in Appendix I to the FEIS.

Comment 2.

Response - This concern is incorporated by reference into the 'USFSW responsibility as a Cooperating Agency' in Chapter I of the FEIS and specified in NEPA regulations 1950.42.

Comment 3.

Response - The Forest Service concurs and is continuing to require this schedule in the FEIS.

Comment 4.

Response - The augmentation of water in the South Fork of Middle Crow Creek is currently being objected to by private landowners because this creek traverses their land. In the past, they have had problems with beavers building dams and flooding their crop and meadow lands during certain times of the year. Over the years they have been able to eliminate this problem and do not wish to have it occur again. The Forest Service, Fish and Wildlife Service, and Wyoming Game and Fish Department are now negotiating with the landowners to devise an acceptable means of mitigating the losses and augmenting stream flows in ways which it will not impact ranchers on the lower Crow Creek System.

Comment 5.

Response - Monitoring programs are a requirement that will be included in the occupancy documents. The cost of the mitigation measures would be borne by the applicant.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Billings Area Office
Federal Building, Room 3D35
316 North 26th Street
Billings, Montana 59101

IN REPLY REFER TO:

ES

June 16, 1981

MEMORANDUM

TO: Bruce Blanchard, OEPR, Washington D.C.

FROM: Acting Area Manager, USFWS, Billings, MT (ES)

SUBJECT: Review of Revised Draft Environmental Statement for Cheyenne Stage II Water Diversion Proposal, Carbon, Albany, and Laramie Counties, Wyoming (ER 81/971)

Our comments are being provided directly to you as per instructions from our Washington Office.

The Fish and Wildlife Service is a "cooperating agency" with the Forest Service for the subject project, in accordance with NEPA regulations. As a consequence, the Forest Service has worked closely with FWS by facilitating and participating in negotiations with the applicant to arrive at mutually acceptable fish and wildlife mitigation measures for expected project impacts.

In general, the DEIS is well written and comprehensive. The FWS feels the document adequately describes fish and wildlife resources and the impacts expected to occur to them as a result of the proposed action and its alternatives.

The least damaging alternative to fish and wildlife resources is Alternative A: "No Action". The FWS encourages selection of this alternative as the best choice for protection of fish and wildlife resources. In addition, we find the Forest Service "Preferred Alternative" to be acceptable (Alternative C: "Modify Stage I Collection System To Increase Capacity And Extend The Proposed System To The Vicinity Of West Branch Of The North Fork Little Snake River.) However, in this respect, see item 1 herein under our "specific comments."

1. As noted in the DEIS, consultation between the Forest Service and FWS i ongoing concerning project effects on threatened and endangered species (Colorado squawfish, bonytail chub, and humpback chub). On May 29, 1981, a biological opinion was issued which addressed "survival aspects" for the listed species; a "final" opinion will be issued not later than July 1, 1982, according to the introductory section of the May 29 opinion. The May 29 opinion should be consulted during preperation of the FEIS.

Following are comments on specific portions of the DEIS.

2. 1. Pages 63-66 - It should be pointed out that FWS support for the Forest Service "Preferred Alternative" is contingent upon the listed mitigation measures being included in "occupancy documents", when issued.

3. 2. Page 64 and Appendix Pages II-149-150 - The FWS supports adoption of the "Forest Service Proposed - Modified Release Schedule I - March 1981" for releases from Hog Park Reservoir versus "Banner Associates-Wyoming State Engineer Proposed Modified Release Schedule - January 1981."

4. 3. Pages 75, 79, 83, 122, and 131 - On these pages reference is made to the Lake Owen to Pole Mountain pipeline terminating at the east boundary of the Medicine Bow National Forest on Pole Mountain. If this is the case, then the environmental consequences of allowing water to flow thru 2-4 miles of natural drainage to the city reservoir should be addressed. This should be considered a major inadequacy in impact assessment and corrected in the Final EIS.

5. 4. Appendix Pages IV-41-44 - FWS recommends that a monitoring program similar to that proposed on these pages be included as a part of permitting requirements. The costs of impact analysis and mitigation measure implementation could justifiably be considered costs of the project and should be paid for by the applicant.

Sincerely,

/s/ Robert M. Ballou

Robert M. Ballou
Acting Area Manager

cc: Regional Director, USFWS, Denver, CO (ENV)
FWS/OEC, Washington D.C.
Don Dexter, Wyoming Game and Fish Department, Cheyenne, WY

F. United States Army Corps of Engineers Letter of July 21, 1980 (See p. V-64)

Comment 1.

Response - This concern has been discussed in further detail in Chapter IV and Appendix IV of the RDEIS. This is also described further in Chapter IV of the FEIS.

Comment 2.

Response - The variation in flows of the Yampa River as a result of Stage II, would be far less than the normal 25% variation in flows which occur on an annual basis.

Development of the EIS is coordinated with the National Park Service study of the Green and Yampa Rivers. The Draft Wild and Scenic Rivers Study-Yampa and Green Rivers (National Park Service, June, 1979) is Document 27, and is on file in the Medicine Bow National Forest Office, Laramie, Wyoming.

Comment 3.

Response - The wetlands discussion has been expanded in Chapter III of the FEIS. The survey work was completed by the Army Corps of Engineers and is included.

Comment 4.

Response - This wording was changed in Chapter I of the FEIS.

Comment 5.

Response - Because power is a recurring cost it was included in annual maintenance. Breakdown of other maintenance costs are in Appendix II to the RDEIS and can be subtracted to determine power costs for each alternative.

Comment 6.

Response - There is a discussion of impacts on the "benthic community" in Chapter IV of the RDEIS and FEIS.

Comment 7.

Response - The methodology to compute salinity impacts downstream can be found in Appendix IV - Section 1 of the RDEIS.

Comment 8.

Response - This is correct, however, this rationale is no longer required in reference to a preferred alternative and was deleted in the RDEIS.

Comment 9.

Response - Water conservation was discussed in more detail in Chapters II and IV of the RDEIS and FEIS. It has also been incorporated in Alternative E which is discussed in Chapters II and IV of the FEIS.

Comment 10.

Response - All of these items have been discussed in more detail in Chapters II, III and IV of the RDEIS and FEIS. Background data can be found in Appendices II, III and IV to the RDEIS.

Comment 11.

Response - The discussion is in Chapter III of the RDEIS and FEIS. North Platte water is always replaced because the permits which Cheyenne has for North Platte River water are junior to others. Therefore, the only time they could take North Platte River water without replacing it would be during flood situations.

Comment 12.

Response - It was considered in the FEIS as a part of each action alternative.

Comment 13.

Response - The discussion of a release schedule is part of the mitigation measures in Chapter II of the RDEIS and FEIS. The USDA Forest Service proposed schedule can be found in Appendix II, p. II-150, of the RDEIS.

Comment 14.

Response - These items and concerns are disclosed in Chapter IV of the FEIS.

Comment 15.

Response - Hydrologic information has been improved. It was furnished by the Army Corps of Engineers. This information can be found in Chapters III and IV of the FEIS.

Comment 16.

Response - This information has been included and can be found in Chapters III and IV of the FEIS.

Comment 17.

Response - Hydrologic information has been improved. It was furnished by the Army Corps of Engineers. This information can be found in Chapters III and IV of the FEIS.

Comment 18.

Response - The discussion of impacts to terrestrial wildlife has been updated and can be found in the RDEIS and FEIS in Chapters III and IV.

Comment 19.

Response - This data was furnished by the Army Corps of Engineers and is now included in Chapters III and IV of the FEIS.

Comment 20.

Response - The original conclusion was based on the Biological Assessment made by the Forest Service. The Forest Service entered into consultation with the Fish and Wildlife Service in February 1979. Their biological opinion was issued on June 1, 1981. For the complete USFWS biological opinion, please refer to Appendix I of this FEIS.

Comment 21.

Response - These concerns have been addressed in more detail in Chapter IV of the FEIS.

DEPARTMENT OF THE ARMY
OMAHA DISTRICT CORPS OF ENGINEERS
6014 U S POST OFFICE AND COURTHOUSE
OMAHA NEBRASKA 68102

RECEIVED
JUL 24 '80
LM&PB

REPLY TO ATTENTION OF
MROPD-A

21 July 1980

Mr. Craig W. Rupp
Regional Forester, Rocky Mountain Region
U.S. Forest Service
11177 West Eighth Avenue
Box 25127
Lakewood, CO 80225

Dear Mr. Rupp:

We have reviewed your Draft Environmental Impact Statement (DEIS) for the Cheyenne Stage II Water Diversion Proposal. Our comments are inclosed.

Construction of the proposed project would require Section 404 permits (Section 404 of the Clean Water Act) from the Corps of Engineers. Although the Corps is not the lead Federal agency in developing the DEIS, we nevertheless have an important stake in this document as it will, when finalized, comprise a significant portion of the data base for our permitting decisions. Thus, we are very concerned that the Final EIS address all necessary permitting information.

We will be meeting with Mr. Don Bolinger, Project Coordinator, and others from your Laramie office on 29 July 1980. We plan to develop procedures whereby we can assist your staff in preliminary review of information critical to our needs prior to finalization of the EIS. We look forward to a close working relationship with your agency.

Sincerely,

John E. Velehradsky

JOHN E. VELEHRADSKY
Chief, Planning Division

Incl
as stated

COMMENTS ON

DRAFT ENVIRONMENTAL IMPACT STATEMENT

CHEYENNE STAGE II WATER DIVERSION PROPOSAL

BY

OMAHA DISTRICT, CORPS OF ENGINEERS

GENERAL

Specificity of Impacts Analysis

Many of our comments on the DEIS stem from the conclusionary manner in which the document was prepared. The DEIS generally reaches conclusions about environmental impacts with little or no descriptions of the baseline environment or analyses of impacts. Table IX is a case in point where many conclusions are reached without previous basis in the DEIS. Considerably more information could be provided without increasing the size of the DEIS as most information is repeated several times between the summary, main body of the report, and the appendix. Many conclusions are apparently based on file information or documents which are not practically available to reviewers. We suggest preparation of a technical appendix summarizing this information.

Stage III

The DEIS states on page 105 that the Stage III diversion proposal is not connected with the Stage II proposal. Wyoming House Bill No. 112 contained in Appendix VIII makes it appear that Stages I, II, and III are phases of
1. the same overall project. <u>The Stage III proposal should be described in the EIS so that the facts are available for an informed judgment.</u> If the three Stages are phases of the same overall project, a programmatic EIS including a cumulative impacts analysis would be required.

Effects on Dinosaur National Monument

2. <u>It is our understanding that the National Park Service was in the process of quantifying reserved flows for Dinosaur National Monument. If so, the EIS should indicate whether the Little Snake River basin diversions would violate these reserved flows. Similarly, the EIS should indicate what effects these depletions would have on the segment of the Yampa River through Dinosaur National Monument proposed for addition to the Wild and Scenic River System.</u>

Wetlands

3. The DEIS makes numerous references to wet meadows. The EIS should indicate whether these areas qualify as wetlands (perhaps Type II). If so, Section 404 permits may be required for any filling activities in these areas. In order for us to determine permitting needs and wetland impacts, all wetlands (also streams and lakes) crossed by the various project features should be identified and discussed.

Section 404 Wording

4. Page 20, Item F.2. The first sentence reads "This permit is required anytime there is land disturbance in a lake, stream or river." It is suggested that the wording be changed to read "Section 404 permits pursuant to the Clean Water Act are required for the placement of dredged or fill material in waterways, lakes, and wetlands."

Table 3-1 Clarification

5. It is not clear that the "annual maintenance cost" under item l.e. of table 3-1 includes electrical power costs. Since power costs are not truly a maintenance cost, a separate energy cost item should be added. This would emphasize the energy efficiency of each alternative which is becoming increasingly important as energy resources become more scarce.

Benthic Impacts Analysis

6. The DEIS assesses the impacts of the alternatives on trout populations but fails to discuss impacts on the benthic community. The impacts analysis is incomplete without this discussion.

Colorado River Salinity

7. The DEIS indicates that the action alternatives will increase the salinity of the Colorado River by 1.73 mg/l. The method used to arrive at this figure should be described.

Public Interest Determination

8. On page 122, item 2.d., the DEIS indicates that "The Forest Service prefers an action alternative rather than the no action alternative in order to favorably respond to the needs of Wyoming people." Perhaps you may also want to indicate that you have considered the national interest as well in making your determination as indicated by your evaluation criteria on pages 32 to 34 so as to demonstrate your balanced approach.

Scoping Process

The scoping process appears very thorough and is commendable.

NEED FOR THE PROJECT

9. Cheyenne's need for additional water is discussed on page 15 in a conclusional manner. On page 39, water conservation is eliminated from further study in a similar conclusional manner. It is not possible to determine the viability of conservation from the DEIS. In-depth discussion is needed to indicate how you arrived at these conclusions as the "need" for the project is essential to our "public interest" determination. Our Section 404 permit decision cannot be made without this analysis. This discussion should include:

10.
- Cheyenne's existing per capita water use rates;
- How these per capita use rates compare with other cities;
- The potential for meeting future water needs by reducing existing per capita use rates;
- The frequency of Cheyenne's water shortage problems;
- The primary contributors to the peak usage and whether these uses can be managed to extend existing supplies;
- Whether all existing water uses are metered;
- How preliminary 1980 Census figures compare with the population projections used in your analyses; and
- A discussion of Cheyenne's water rate structure and whether other rate structures would promote greater conservation.

FORMULATION OF ALTERNATIVES

All alternatives include replacement of North Platte River basin water with Little Snake River basin water (except Alternative E which uses Little Snake River basin water directly). Presumably this is necessary because all North
11. Platte River basin flows are already appropriated. Discussion is needed to confirm why North Platte River water is always replaced. If water rights or other factors do not necessitate replacement of North Platte River basin flows, then an alternative (or alternatives) should be developed which does not involve replacement waters from the Little Snake River basin. If Wyoming's water rights system allows purchase of water rights from holders of prior rights such that Cheyenne could purchase additional water without the necessity of providing replacement from the Little Snake River basin, then consideration should be given to development of an alternative based on this principle. It may well be that these approaches are not possible or are unacceptable. However, they should nevertheless be discussed so as the reviewer is aware of all possible options.

12. The DEIS concludes that water conservation is not a viable alternative. Although water conservation may not be viable alone, it should be considered for inclusion as a component of the selected alternative. Water conservation may offer the potential to reduce environmental impacts by allowing a reduction in the extent of the Stage II system or may allow postponement of environmental impacts by extending the time period that Stage I and Stage II facilities can accommodate Cheyenne's water needs.

13. The DEIS indicates that lower Hog Park Creek may not be able to accommodate the extra releases from Hog Park Reservoir. A water release schedule to minimize damages (page 4 et al) is suggested. Wyoming House Bill No. 112 (page VIII-4) indicates that a pipeline would be built from Hog Park Reservoir to the Encampment River. It appears that the alternatives should be modified to include the pipeline.

CONSTRUCTION

Our Section 404 permitting must specifically address the impacts of placement of dredge or fill material in streams, lakes, and wetlands. The types of facilities to be placed in waters are described in a very general manner on pages 40 and 41. However, little information is presented on the types of construction activities which would occur in these waters. Information on construction timing, handling of flows during construction, construction of temporary measures such as cofferdams and road fills, utilization of sediment catchment basins, erosion control measures, stabilization of channels through work areas, source of fill materials (particularly for the dam construction), and method of pipeline crossings of streams are required for our future evaluations. The chemical, physical, and biologic impacts of dredge or fill material placement also must be addressed. A general construction schedule should also be provided to enable the reviewer to understand the extent and duration of construction impacts.

Your internal staff suggestions for mitigation of adverse environmental impacts during construction are spelled out clearly on pages VIII-14, -34, and -35 of the appendix. The suggested mitigation measures contained in the main body of the DEIS, however, are much less numerous. Thus, it appears that
14. many of the construction impacts would not be mitigated. The adoption of mitigation measures is at the option of the City of Cheyenne; however, if these measures are not adopted the EIS must address the associated impacts. A case in point is the release of highly turbid waters into streams during the annual cleaning of diversion structures as described on page VIII-21. This impact is not addressed in the DEIS nor is a commitment provided to insure that it will not be a problem during Stage II operation.

The new CEQ regulations require that the EIS provide specific mitigation commitments rather than general suggestions. The Final EIS should indicate which mitigation measures the project sponsor is committed to.

HYDROLOGY

The various action alternative proposals under Stage II in conjunction with the existing Stage I facilities would result in the diversion of from 21,500
15. to 27,500 acre-feet of water from the Little Snake River basin. Information is seriously lacking on the hydrologic impacts downstream from the diversion points. Without this information, it is not possible to assess the amount and seriousness of downstream impacts. This is particularly important because of the existence of endangered and threatened species in the potential area of impact.

16. The EIS should provide information on the flows at diversion points, and their variability including diurnal, daily, monthly, and annual variations. Information should also be provided on the amount of water diverted under various flow conditions so that the reviewer can develop an insight to the hydrologic and resultant biologic (and other) impacts. The streamflow depletions and resultant impacts should be traced downstream until they are no longer discernible or are insignificant. You may want to refer to the Supplemental Environmental Impact Statement for the Missouri Basin Power Project (Grayrocks Reservoir) for an example of this type of analysis. If you don't have a copy of the Supplemental EIS and the Technical Appendix, we would be happy to furnish copies.

Additional hydrologic information should also be furnished for the North Platte River basin as various reaches of streams will be affected by the diversions and the supply of replacement waters. It appears that Douglas Creek downstream from the diversion dam and the North Platte River between the confluences of Douglas Creek and the Encampment River could be significantly affected by the Douglas Creek diversion. The DEIS does not contain information on the baseline environment in these areas nor does it assess impacts, either hydrologic or other. Hydrologic information is also required for the Encampment River downstream from Hog Park Creek and the North Platte River downstream from the Encampment River confluence. Some of the analyses in the North Platte River basin may not have to be as rigorous as for the Colorado River basin as the impacts would appear to be less. It is quite possible that some of these impacts could be beneficial (i.e., timing of reservoir releases, for example). These should be described so that the proposed action can receive proper credit.

17. Hydrologic information is likewise lacking on Middle Crow Creek which would be used to transport water under several of the alternatives. It is not possible to determine the flow regime that would exist should any of the alternatives be implemented. It would appear from page VIII-32 that suitable trout habitat would be created. Hydrologic information is needed to determine whether there would be adequate flows at all times so as to assure maintenance of this habitat.

The discussion pertaining to the 22 March 1979 scoping session described on page 126 indicates that at least part of the various hydrologic analyses may already have been completed. Perhaps the DEIS simply fails to adequately discuss the results of the hydrologic analyses.

TERRESTRIAL BIOLOGY

Considerable information is provided on fishery impacts. However, the DEIS treats the subject of terrestrial habitat losses lightly. Figures are provided on the number of acres inundated by reservoir construction and the number of AUM's of forage lost, but no information is presented on the impacts to game and nongame animal species. Furthermore, the habitat loss due to construction of roads, pipelines, and other facilities is not quantified nor evaluated. Finally, the DEIS adds insult to injury by concluding without explanation that terrestrial habitat losses will not be mitigated.

18. The impacts of terrestrial habitat losses must be evaluated in the EIS. Besides direct impacts of habitat loss, this evaluation should address the impacts of roads on wildlife utilization of adjacent habitat (disturbance) and the effects of increased hunter access on wildlife populations. The DEIS considers increased hunter access beneficial whereas from a wildlife population perspective increased access is likely detrimental.

SOCIOECONOMIC

19. Page 22 contains a heading "Social Environment." Population is the only item addressed. Specific socioeconomic baseline and impacts information should be presented for all areas potentially impacted including:

a. Local economy and human activity,

b. Area growth and trends

c. Population and employment,

d. Housing,

e. Schools,

f. Land use,

g. Public facilities and services,

h. Aesthetic values, and

i. Community cohesion.

It is particularly important that socioeconomic information be presented for the portion of the Colorado River Basin potentially impacted by the stream diversions. The DEIS indicates that some Colorado River basin communities who are dependent on the same flows Cheyenne intends to divert will soon exceed their available water supplies. The EIS should discuss how the reduced flows resulting from Cheyenne's proposed diversion would effect these communities as well as downstream ranchers and irrigators. The EIS should also indicate what impacts will occur in these small communities as a result of an influx of construction workers and their families.

ENDANGERED SPECIES

20. The DEIS indicates on page 8 (Table 3-1: 4.h. and 4.j.) that the proposed alternatives would not affect sensitive, threatened, or endangered species. This conclusion would appear to be premature prior to receipt of the Fish and Wildlife Service's biological opinion. It should be made clear that the conclusions presented are strictly those of the Forest Service.

It is not possible for the reviewer to assess the impacts on threatened or endangered species from the information presented in the DEIS. The lack of hydrologic baseline and impact data for the Colorado River basin is described in the "Hydrology" comments. Neither is biologic information presented on the flow needs and sensitivity of the threatened and endangered species. This information is essential to informed decision making.

ENLARGEMENT OF HOG PARK AND ROB ROY RESERVOIRS

21. The effects of expansion of the Hog Park and Rob Roy reservoirs should be discussed in more detail. Information that should be added includes:

a. Whether trees will be removed.

b. Whether soils and organic matter in the newly inundated area will affect water quality.

c. The impacts on the aquatic environment (i.e., benthic organisms, microflora, microfauna, aquatic plants).

d. The effects on recreation during construction and following enlargement (e.g., increase in peak day visitation due to the enlargements).

e. Whether there will be any shoreline development.

f. The effect on terrestrial habitat resulting from the inundation (i.e., is the terrestrial habitat important to big game species as wintering area or for other purposes).

All action alternatives would involve construction or expansion of water storage reservoirs. Information in excess of that provided on page 41 should be presented as to the safety of the existing Hog Park and Rob Roy dams and safety provisions which would be incorporated in any expansions (e.g., emergency spillway modifications, embankment flattening, etc.). Alternative D does not appear viable in light of the admission on page 58 that the proposed dam site on the North Fork of the Little Snake River "...does not appear to be a suitable site."

G. United States Army Corps of Engineers Letter of July 10, 1981 (See p. V-70)

Comment 1.

Response - The justification for the population projections can be found in Chapter III of the FEIS. The methodology used is found in Appendix I of the FEIS.

Comment 2.

Response - These items were discussed individually as Alternatives in Chapter II of the FEIS. They are combined into Alternative E which is discussed in Chapters II and IV of the FEIS. Development of these Alternatives were a cooperative effort of the Forest Service, EPA and Army Corps of Engineers.

Comment 3.

Response - The cumulative impacts have been assessed and written by the Army Corps of Engineers. Cumulative Impacts are included in Chapter IV of the FEIS.

DEPARTMENT OF THE ARMY
OMAHA DISTRICT CORPS OF ENGINEERS
6014 U S POST OFFICE AND COURTHOUSE
OMAHA NEBRASKA 68102

REPLY TO ATTENTION OF

MROPD-A 1 0 JUL 1981

Mr. Craig W. Rupp
Regional Forester, Rocky Mountain Region
U.S. Forest Service
11177 West Eighth Avenue, Box 25127
Lakewood, CO 80225

REGIONAL FORESTER
JUL 14 1981

Dear Mr. Rupp:

I am submitting my comments on the Revised Draft Environmental Impact Statement (RDEIS) for the Cheyenne Stage II Water Diversion Proposal. The comments are the result of a review of the RDEIS and the transcripts of testimony for the three public hearings held at Laramie, Cheyenne, and Baggs, Wyoming, on 9, 10, and 11 June 1981, respectively.

My comments cover only the major issues. My staff supplied detailed comments on the lesser issues for the preliminary RDEIS on 18 February 1981. These lesser issues have either already been resolved in the RDEIS or are currently being resolved through the joint efforts of our agencies. Briefly, these issues include:

a. Hydrology

b. Impacts on wetlands

c. Impacts on Rob Roy and Hog Park Reservoirs

Discussion of the hydrology of the affected streams is lacking in the RDEIS, but I have agreed to furnish an acceptable hydrology write-up for inclusion in the Final EIS. Also, my staff is working jointly with your agency to obtain more specific information on impacts to the wetlands and the two reservoir expansion areas. Through this work we expect to resolve our problems with these issues.

My staff has previously commented on endangered species as a major issue. The endangered species issue has since been resolved by the U.S. Fish and Wildlife Service's biological opinion of 1 June 1981 with the exception of the cumulative impacts analysis as discussed later in my comments.

MROPD-A 1 0 JUL 1981
Mr. Craig W. Rupp

There are several major inadequacies in the RDEIS. We commented on these in the review of the original draft in July 1980 and again during the review of the preliminary RDEIS. The fact that these issues were repeatedly addressed at the public hearings reinforces my views of the propriety of our previous comments. These issues include:

a. Need for the project.

b. Scope of alternatives

c. Cumulative impacts analysis.

Each of these issues is discussed in detail in the inclosed comments.

The National Environmental Policy Act requires that the major issues discussed in my comments be adequately addressed in the Final EIS. Numerous court decisions have established the scope and depth of the necessary analyses. I am specifically required by our regulations to either ensure that an EIS prepared by another agency is adequate for our purposes or to supplement the EIS if it is inadequate. The resolution of the major inadequacies of the RDEIS is urgent because of the public interest review I must perform prior to my decision on the Section 404 permits. We have repeatedly commented on these major issues but they remain unresolved. I would like to meet with you soon to impress upon you the seriousness of our concerns. Please call me at your earliest convenience (FTS 864-3901).

Sincerely,

THOMAS K. HICKLIN
LTC, Corps of Engineers
Deputy District Engineer

1 Incl
As stated

COMMENTS ON
REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT
BY
OMAHA DISTRICT, CORPS OF ENGINEERS

Need for the Project

The RDEIS contains significantly more information on need for the project than your original draft. The section on conservation and incorporation of variable per capita water use rates has contributed considerably to the credi-

1. bility of this section of the RDEIS. My remaining concern is with the failure to justify the population projections that were used. The historical growth rate of Cheyenne has been much slower than projected for the future. The accelerated growth figures should be analyzed to make sure they are fully defensible. As a minimum, this supporting information should be included in the technical appendix.

My staff has attempted to duplicate your population projection adjustments as necessitated by the results of the 1980 census. However, we have not been able to verify your analyses because of the lack of distinction between Cheyenne's population and that of its water service area which also includes the South Cheyenne Water and Sewer District and other outlying areas. Whenever population figures are used in the EIS, it is important that they specifically state whether they represent Cheyenne or Cheyenne's water service area. It is imperative that the population information used in the EIS be correct and defensible because of its critical effect on need for the project.

Scope of Alternatives

The RDEIS discusses alternative methods of gathering Stage II water for use in Cheyenne. I do not agree that this represents an adequate range of reasonable alternatives as required by the National Environmental Policy Act (NEPA). Further discussion of several of the alternatives identified but then rejected before analysis in the RDEIS would remedy the inadequacy. It would appear from the multiple comments received at the public hearings concerning the potential linking of Stage II and Stage III that it would be expedient to fully develop the range and depth of the alternatives rather than risk being burdened with a programmatic EIS. Alternatives that appear to be potentially viable include:

2.

a. Agricultural water rights acquisition.

b. Groundwater development.

c. Conservation including possible recycling for watering of parks and similar uses.

As documented in the hearing testimony, other cities in the area including Laramie and Casper have acquired agricultural water rights recently, so it is difficult to justify the premature rejection of this as a possible alternative. Implementation of this alternative may not be desirable--particularly from a local viewpoint--but its impacts should at least be analyzed in the EIS. Groundwater development may also be a viable alternative. The lack of information regarding aquifer quality or the effects on other users appears to be the major reason for your rejection of this alternative. When the cost of investigation to obtain the detailed information is excessive, NEPA allows use of the best available information in formulating alternatives. I would much prefer that an alternative be developed from the best available information rather than rejection of all such alternatives resulting in the very limited scope of alternatives retained in the RDEIS.

If the evidence for each alternative does not support the availability of water in the quantities required by Cheyenne for the future, it may be necessary to treat agricultural water rights acquisition, groundwater development, and conservation as components of a single alternative. We have suggested this concept previously and it was again discussed in the hearing testimony in Laramie. It appears that this combination of components could supply Cheyenne's future water needs; therefore, it is at least worthy of analysis in the EIS.

Cumulative Impacts Analysis

3. The lack of cumulative impacts analysis is disturbing to me since cumulative impacts have played a very significant role in other similar projects for which a Section 404 permit was required. The most notable of these is the Grayrocka project on the Laramie River for which court action established that a cumulative impacts analysis was essential in the EIS. The issues of downstream endangered species and the effects on other fish and wildlife and agricultural interests were extremely similar.

As you are well aware, the U.S. Fish and Wildlife Service's biological opinion for Stage II did not address cumulative impacts. I fully expected that such an analysis would be conducted as the Fish and Wildlife Service's letter to your agency dated 4 October 1979 indicated that there were 14 major water development proposals above the Yampa River that they were concerned about. I had hoped that this cumulative impacts analysis would be available for incorporation in the Final EIS. I am notifying the Fish and Wildlife Service about my concerns and am planning to initiate Section 7 consultation to resolve this issue.

The cumulative impacts analysis appears particularly pertinent in this case because of the extensive water development currently proposed for the Little Snake River and downstream areas. The Little Snake River Water Management Project (popularly known as Stage III) is probably the most notable of the proposed projects. This project would involve the removal of about 100,000 acre-feet annually from the headwaters of the Little Snake River drainage and could impact many of the same downstream areas as could Stage II. This would appear to be particularly true for the downstream areas where the endangered species are located. Another possible influence on the area would be the water requirements for the extensive energy development activities that already are occurring or are planned for the upper Colorado River basin of which the Little Snake River is a part. The ensuing population growth, as discussed in the hearing testimony at Baggs, would further add to the water requirements. The EIS should analyze the impacts of all reasonably foreseeable development on the downstream areas and indicate the contribution of Stage II to the total impact.